

SOCIO-ECONOMIC SURVEY
OF
SMALLHOLDER FARMING SYSTEMS IN SOLOMON ISLANDS

NORTH-WEST PENINSULA
MAKIRA PROVINCE

Agricultural Economics Section
Rural Services Project
Ministry of Agriculture and Lands
Solomon Islands

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Abbreviations and Units of Measure

AES	Agricultural Economics Section (RSP)
CEMA	Commodities Exporting and Marketing Authority
DCRS	Dodo Creek Research Station
LDA	Livestock Development Authority
MAL	Ministry of Agriculture and Lands
PBME	Project Beneficiary Monitoring and Evaluation (RSP)
RDC	Rural Development Centre (RSP)
RSP	Rural Services Project
km	kilometre = 1,000 m
ha	hectare = 10,000 sq m
m	metre
MT	metric tonne = 1,000 kg
SI\$	Solomon Islands Dollar

Acknowledgements

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Many others contributed to the planning of the programme and in its implementation. The study would not have been possible without the support and patience of local people. To them we are grateful and hope that the present report will be in some way of benefit.

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Chapter: 1

INTRODUCTION

1.1 The Solomon Islands comprise a double chain of islands extending in a north-west south-east direction over 860km of the south-west Pacific between latitudes 5° - 12° S and longitudes 155° - 170° E. The islands lie directly along a major line of crustal weakness traversing the western Pacific and are the surface expressions of fault-bounded blocks and troughs originating in a zone of geologically intense activity. Warping and block movement are the most significant geomorphic processes responsible for the elevation of land to its present altitude, with marine sediments occurring on some of the highest ranges. Such processes continue spasmodically and raised reefs at various heights occur in many parts of the country, as does intense faulting. Earthquakes are frequent and often initiate land movements in ground already close to shearing point such as saturated soil at the heads of steeply incised gullies, resulting in debris slides among the high ridges (10).

1.2 Solomon Islands lies well within the geographical tropics in an oceanic area where two contrasting trade winds meet, a low-pressure belt of ascending air known as the "inter-tropical convergence zone" (ITCZ). In this zone warm and humid air masses drawn from equatorial regions meet relatively cool and dry sub-tropical air derived from the south-east. From about March to November the islands experience steady, shallow, south-easterly winds. During November and December unsettled weather is likely as the ITCZ moves south over the islands, from which follows steady north-westerly winds. March and April are again unsettled as the ITCZ returns northwards until the south-easterly trade winds become re-established. Cyclonic disturbances may be generated, particularly around December and April when the convergence of the two air streams is strongest. Weather is varied, both temporally and spatially, but is characterised by continually high average temperatures and humidity. Most land areas have a mean annual rainfall of 3,000-5,000mm with variations depending on latitude and orientation to prevailing winds. Temperatures are more uniform, at around 26° C in the lowlands, and never reach extremes which would restrict plant growth. Night time humidity exceeds 90%. This may fall to 60% on clear sunny days, or remain close to saturation point during cyclonic conditions (10).

1.3 The islands are rugged, with a predominance of ridge-valley landscapes and high relief. Undulating rolling landscapes have a limited distribution and extensive fluvial plains are uncommon. Chemical weathering is intense under conditions of continuously high temperature and moisture, however, soil depths are not generally great. Most hill areas have slopes exceeding $12-15^{\circ}$ and commonly reach $35-55^{\circ}$ among the mountain ridges. Continual soil wash and creep and periodic mass movements effectively keep pace with rock weathering. Only on stable flatter sites do deep profiles develop. The islands for the most part are covered in dense forest, some fire disclimax grassland in parts of Guadalcanal⁽¹⁰⁾ and Florida Islands, and land cleared or cultivated.

1.4 The population of Solomon Islands from the 1986 census was 285,176, with an annual growth rate of 3.5%. The land area of 28,370sq km gives a low overall population density of 10 persons per sq km. Settlements are mostly along the coastal margins so that in some parts of the country population densities are high.

1.5 The population distribution of Solomon Islands is summarised in diagram 1.1 and key socio-economic data are presented in table 1.1

1.6 There is a considerable variation between land area and population among the provinces. While Western Province accounts for 33% of the national land area it contains only 19% of the population. The West is characterised by low population density compared to provinces such as Central, Malaita and Temotu. Although Temotu contains 5% of the national population it also accounts for only 3% of the national land area, and therefore has a relatively high mean population density. Land area in Solomon Islands is summarised in diagram 1.2.

Table: 1.1
SOLOMON ISLANDS KEY DATA

Province	Western	Isabel	Central	Guadalcanal	Honiara
POPULATION					
1986 population	55,250	14,616	18,457	49,831	30,413
annual growth rate	3.0	3.2	2.9	4.3	6.8
% national population	19	5	6	17	11
peri-urban population	3,710	1,901	1,622		30,413
% peri-urban	7	13	9	38	
number of households	7,942	2,362	3,079	8,072	4,317
LAND AREA					
land area (sq km)	9,312	4,136	1,286	5,336	22
% land area	33	15	5	19	0
population density/sq km	6	4	14	9	1,382
1987 PROVINCIAL GOVERNMENT REVENUE AND EXPENDITURE (SIS'000)					
revenue	443	173	191	281	1,033
grants	2,556	634	623	1,247	704
current expenditure	3,504	849	750	1,431	1,561
capital expenditure	200	58	88	192	177
net revenue (negative)	(705)	(100)	(24)	(96)	(2)

Province	Malaita	Makira	Temotu	Total
POPULATION				
1986 population	80,032	21,796	14,781	285,176
annual growth rate	2.7	3.6	2.8	3.5
% national population	28	8	5	100
peri-urban population	3,252	2,588	1,295	44,781
% peri-urban	4	12	9	16
number of households	12,417	3,278	2,375	43,842
LAND AREA				
land area (sq km)	4,225	3,188	865	28,370
% land area	15	11	3	100
population density/sq km	19	7	17	10
1987 PROVINCIAL GOVERNMENT REVENUE AND EXPENDITURE (SIS'000)				
revenue	339	485	160	3,103
grants	1,891	1,095	445	9,195
current expenditure	2,190	1,472	615	12,371
capital expenditure	331	600	0	1,646
net revenue (negative)	(291)	(492)	(10)	(1,719)

Source: Statistics Office Statistical Bulletin 15/87 "Provincial Statistics"
Populationa data revised from Statistics Office Statistical Bulletin 3/88 "Solomon Islands Population Census"

POPULATION COMPOSITION

% by province

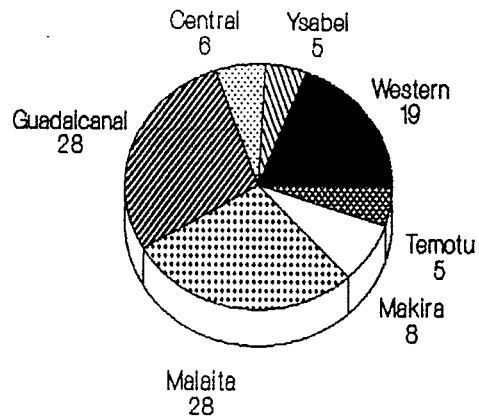


Diagram: 1.1

LAND AREA

% by province

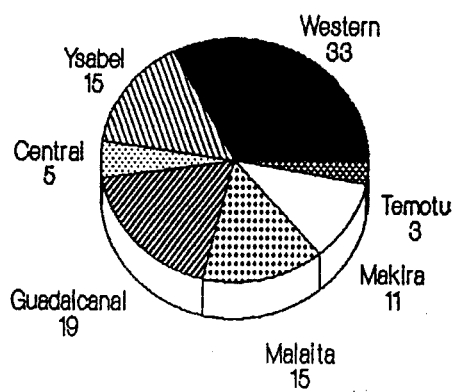


Diagram: 1.2

1.7 While a provincial comparison presents a broad indication of population densities throughout the country, differences within provinces are of significance to agricultural policy. With improvements in communications and administrative links there has been a general migration to the coastal margins where travel and marketing are easier, and where services such as schooling and health are more readily available. The highland interior tends to be sparsely populated in comparison.

1.8 While the overall population density is low, in some areas a growing population pressure is causing concern. Traditional farming systems based on forest fallow may be sustained under conditions of low pressure, but run into soil fertility and related problems when fallow periods are reduced and cropping intensified. Conversely, there are sparsely populated areas of agricultural potential where communications and services are poorly developed. The Rural Services Project is developing facilities in areas of high agricultural potential, providing marketing and transport infrastructure, agricultural and training services, and extending the coverage of adaptive research. These provide new opportunities for agricultural development.

1.9 The capacity of government to implement development programmes is to a large extent determined by funds and resources available. Diagram 1.3 summarises provincial government revenue and expenditure in 1987. Nationally there was a deficit of SI\$1.7 million arising through over expenditure in all provinces. Provincial finance is characterised by a low revenue earning capacity, being nationally about one third of the level of central government grants. Revenue and grants are expended almost entirely on basic operating costs, although these remain severely constrained and under-funded. There are little or no funds for development, and investment amounted to only 12% of total expenditure in 1987.

1.10 Agriculture accounted for 42% of export earnings in 1985⁽¹¹⁾, although this has dropped from the much higher level of 87% in 1960. It is the major employment activity in the country and the source of livelihood for the majority of the population.

GOVERNMENT FINANCE

SI\$'000 by province (1987)

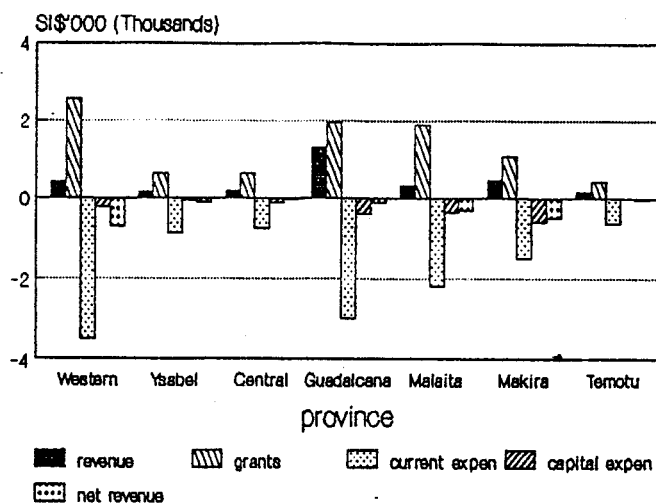


Diagram: 1.3

1.11 Despite various studies undertaken in the past, there is little hard socio-economic data on smallholder farming systems which would assist agricultural policy makers, trainers, extension workers and researchers in the planning, implementation and evaluation of development activities. A national sample survey of agriculture was conducted in 1974-75⁽⁵⁾, but these data are no longer able to satisfy information requirements.

1.12 The Agricultural Economics Section (AES) was established under the Rural Services Project (RSP) inter alia in order to generate statistical information on smallholder production systems for the quantification of constraints to agricultural development and the devising of appropriate agricultural research programmes. The present study is part of a national survey programme to generate detailed base-line data on smallholder farming systems.

1.13 Since September 1987 AES has conducted a series of farming systems surveys in selected sites throughout the country, such as in the immediate areas of influence of Rural Development Centres or in other areas of special agricultural interest. It is intended that the findings of the survey will find application in the evaluation of development activities, and will assist in the assessment of changes taking place in Solomon Islands agriculture and the formulation of development strategies. The background and justification for the survey programme are documented in the AES Inception Report of 1987⁽²⁰⁾. Methodologies are described in the Agricultural Economics Field Survey Manual⁽²¹⁾ and related documents produced by AES.

1.14 The North-West Peninsula survey in Makira Province was conducted among the coastal villages from Rumahui to Tawainia'u in the vicinity of the Rural Development Centre at Maro'u Bay. Field work was conducted from March to June 1988 and covered a sample of 40 rural households. Two stage systematic random sampling was guided by the Statistics Office based on equal probability of household selection, with accessibility taken into account in the definition of the sample frame. Villages were listed from the 1986 population census and selected by systematic random sampling. A pre-determined number of households within each village (or cluster of small villages) were then selected by simple random sampling. Maps of the survey area are presented in diagrams 1.4 and 1.5.

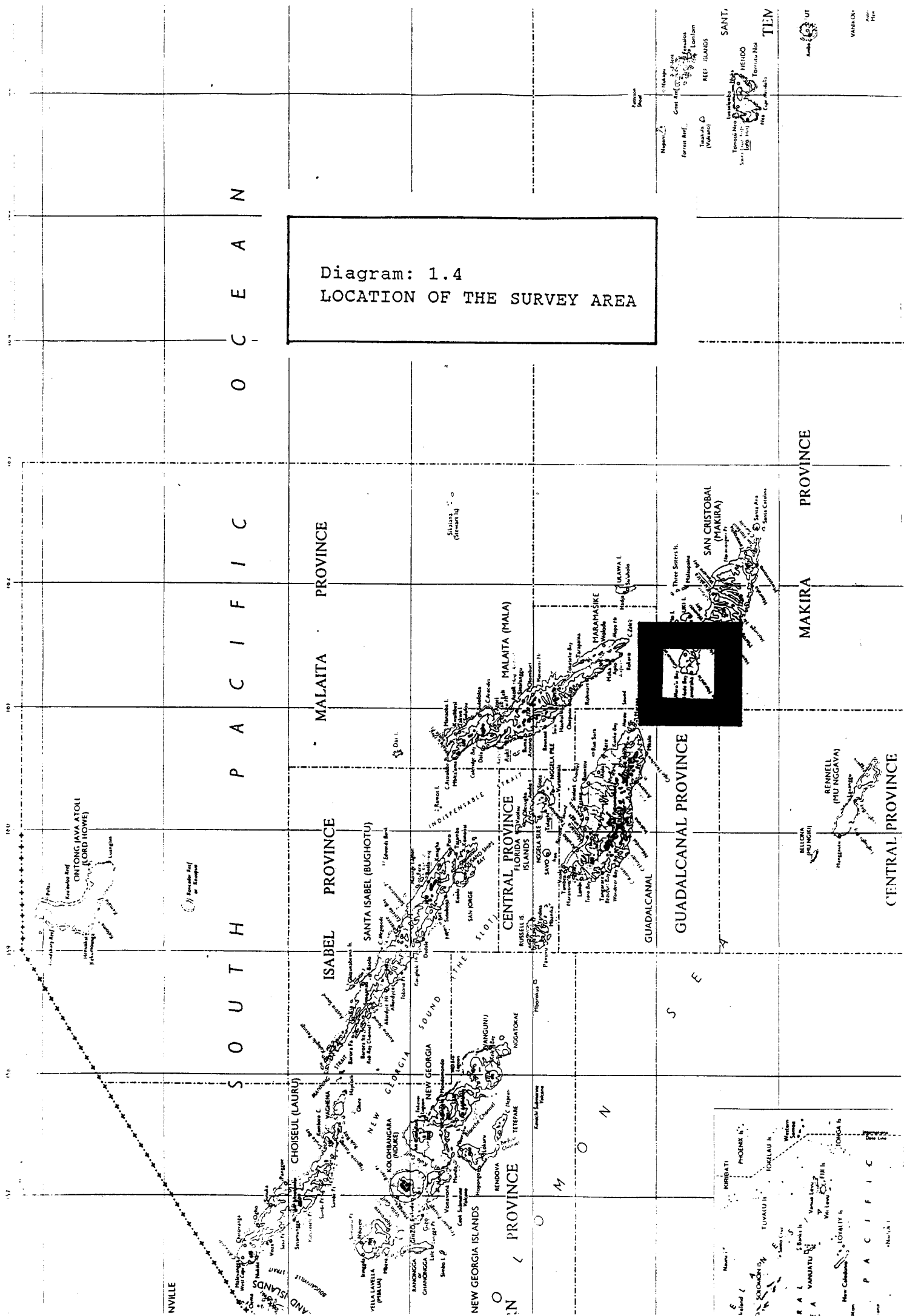
1.15 The survey is designed to investigate the structure and dynamics of smallholder crop and management systems. Of particular importance in the socio-economics of smallholder agriculture is the allocation of labour, since few cash inputs are applied and little wage labour is employed.

1.16 All cultivated areas, including cropped and cleared land, are measured by tape and compass to an error tolerance of 5%. Crop areas are computed and checked in the field by programmable calculator. Data are processed in "dBASE III Plus" databases and analysed through "SPSS/PC+". Raw output is transferred to "Lotus 123 v2" spreadsheets for tabulation and secondary processing. Text tables are incorporated into "Wordstar Professional v4" and graphics are edited in "Harvard Presentation Graphics".

1.17 The Agricultural Economics Programme is sponsored under the Rural Services Project of the Ministry of Agriculture and Lands which is co-financed by the Government of Solomon Islands and ADB/IDA/IFAD. Data processing and the presentation of results has been made possible by the generosity of the Government of New Zealand through its Miscellaneous Technical Assistance Programme. This has overcome a primary constraint to work of this kind in the Ministry of Agriculture and Lands through the provision of computing hardware.

PACIFIC OCEAN

Diagram: 1.4
LOCATION OF THE SURVEY AREA



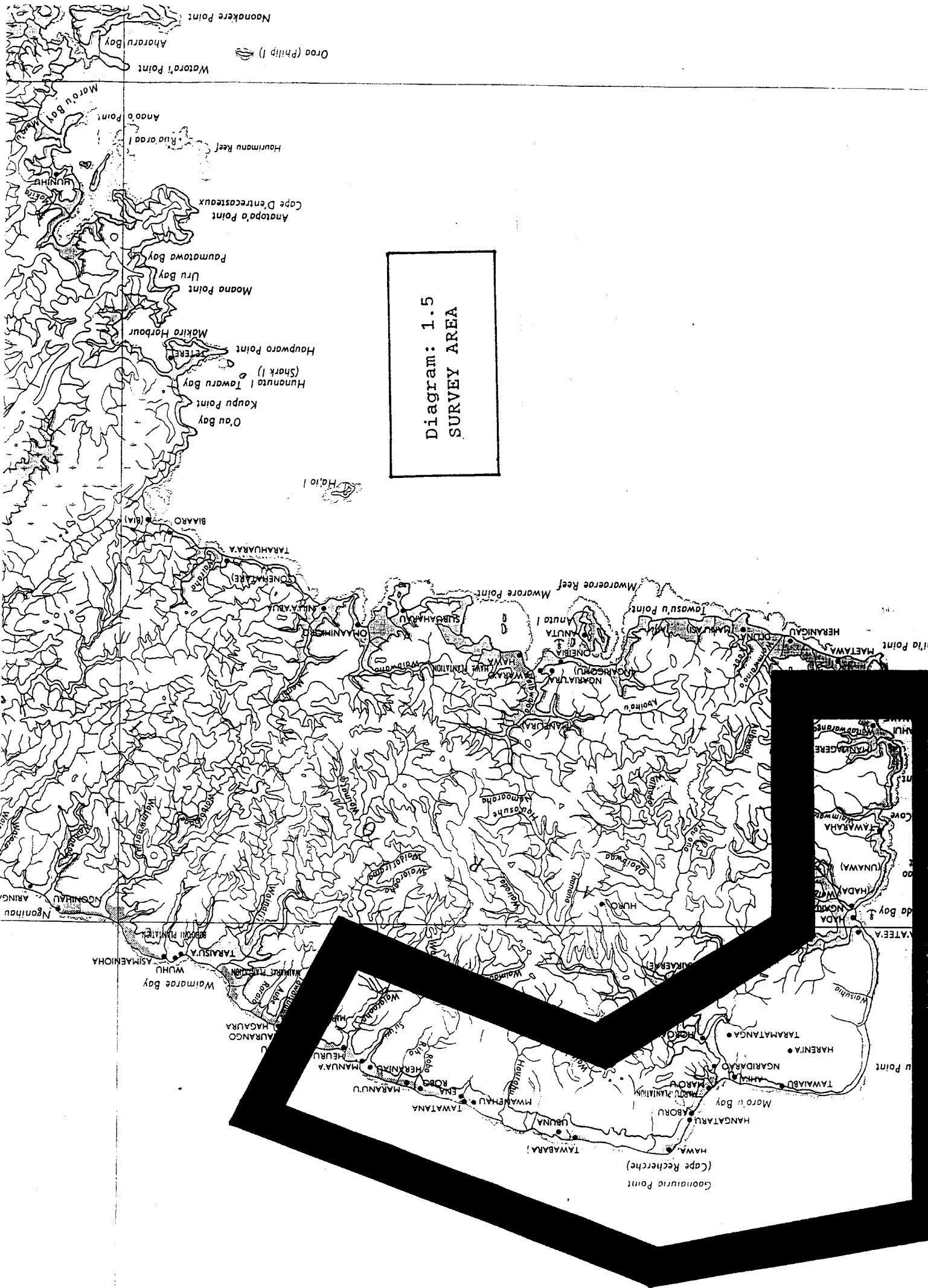


Diagram: 1.5
SURVEY AREA

Chapter: 2

SUMMARY AND MAIN FINDINGS

Household Composition

2.1 The mean household size in the survey area is 7.23, comprised of 3.78 males to 3.45 females, a ratio of 1:0.91 males to females.

2.2 In the sample of 40 households the available labour composition of rural households in the survey area is an equal balance of 1.88male:1.88female out of a total of 3.76 adult equivalent labour units per household.

Income Earning Activities

2.3 Agricultural income earning activities in the survey area are mainly the sale of food crops, fishing and the sale of copra. 35% of sampled households earn income from food crop sales, 13% earn income from minor cash crops, and 3% from livestock sales. 30% of households earn income from fishing.

2.4 23% of households earn income from copra and 5% of households earn income from cocoa.

2.5 5% of households (2 households) have a profession in teaching. 13% of sampled households earn income from private shops and 30% of households earn income from cooperative shops.

Extension and Mass Media

2.6 67% of households listen to agricultural programmes on the radio. Simple written materials may be appropriate in extension since 85% of households have at least one member with some reading and writing ability.

2.6 22% of households are visited by agricultural extension workers, whether government or non-government, at least once per year. 30% of farmers have attended a training course or village meetings.

Livestock

2.7 There is a very low level of commercialism in the management of livestock in N W Peninsula where the most important livestock are pigs and chickens. Only one sampled farmer has a cow.

2.8 43% of farmers keep pigs with a mean herd size of 1.24 among owners. Chickens are kept by 50% of households with a mean flock size of 9.95 among owners. 5% of households keep ducks with a mean flock size of 5.

Holding Size Distribution

2.9 The mean holding size in terms of area cultivated is 1.386ha but the holding size distribution is moderately skewed in that 72% of farmers have holdings of less than the mean size.

2.10 Inequality in holding size can to a large extent be explained by whether or not farmers have coconuts. Such holdings tend to be larger than non-tree cropping holdings, with a mean size of 2.040ha and represent 64% of farmers. Conversely non-tree cropping farmers have a mean holding size of 0.219ha and represent 36% of sampled farmers.

2.11 97% of farmers grow traditional subsistence or food crops, where the area cultivated to these crops is fairly uniform among all farmers. The mean food crop area is 0.262ha and the mean tree crop area is 1.765ha.

Labour Density

2.12 The mean labour availability is 3.80 adult equivalent labour units per household, resulting in a mean labour density of 2.74 labour units per hectare. There is no apparent association between labour availability and holding size but labour density per unit area falls rapidly from 20.31 labour units per hectare on holdings of less than 0.25ha in size to 0.55 labour units per hectare on holdings of 5 - 10ha in size. On non-tree cropping holdings the mean labour density is 15.95 labour units per hectare compared with 1.95 labour units per hectare on tree-crop holdings. Labour may be limiting on larger holdings.

Cropping Patterns

2.13 The average holding size is 1.38ha, however, a distinction is made between farmers with tree crops and those with no tree crops. Of households with tree crops the mean holding size is 2.05ha, of which 1.77ha is under tree crops and 0.28ha is food crops. In contrast non-tree crop farmers have a mean holding size of 0.22ha under food crops. Despite the small size of holdings smallholder cropping patterns are complex and diverse, with 9 dominant crops recorded and a total of 67 distinct mixtures.

Coconuts and Cocoa

2.14 Maintenance standards in the survey area are fairly high, with most plots brushed at least to shoulder height, except in 55% of coconut stands which have a ground cover of secondary bush. Overall 28% of plots undercropped (ie new plantings in food gardens), 22% are brushed to ground level, 16% are brushed to shoulder height and 34% have a ground cover of secondary bush.

2.15 In the survey the coconut variety is mainly local tall although there is one occurrence of Rennel palms. 41% are eight years or less in age, 15% all 9-16 years and 44% are 17-40 years.

2.16 76% of cocoa plantings are less than three years of age, 16% are 3 - 5 years and 8% are 6 - 25 years. 50% of cocoa is grown under coconuts, the rest under planted or, more commonly, natural shade.

Fallow

2.17 Fallow in Solomon Islands farming systems is necessary for the maintenance of soil fertility, particularly for the replenishment of potassium in ash following burning. Shifting cultivation has other valuable characteristics, not least its phytosanitary qualities. The fallow period is an indicator of land pressure, and possible fertility and pest problems associated with intensive cultivation. On food gardens where it is known, there is a fallow period of 6 years, but 93% have a fallow longer than memory. Root crops are typically grown over 2 to 3 harvests before reverting to fallow.

2.18 93% of all gardens have a fallow of primary or secondary forest extending over 97% of the cultivated area.

2.19 50% of the current food garden area was cut from primary forest compared with 9% of the tree crop area.

Landform

2.20 65% of tree crop gardens representing 78% of the tree garden area are on lowland sites. 49% of food crop gardens representing 50% of the food garden area are on lowland sites. Other gardens on upland, sloping sites.

2.21 The mean slope is 5 degrees. 65% of all plots, representing 80% of the total cultivated area are on sites of less than 5 degrees slope. 13% of the cultivated area is on slopes of 5 to 10 degrees and 8% is on slopes of 10 to 30 degrees.

2.22 No conservation measures or alley cropping are practiced.

2.23 The mean distance of gardens from households is .519 hours, with a maximum recorded distance of 4.30 hours. There is no apparent association between garden size, crop type, and distance of garden from the household.

Adverse Factors Affecting Production

2.24 86% of gardens representing 83% of the cultivated area have no apparent site limitations. Poor soil and site factors are regarded as constraints on 5% of gardens (6% of area); pests and disease are a problem on 9% of gardens (4% of area); weeds are a problem on 4% of gardens affecting 7% of the cultivated area.

2.25 The dominant problem is rat damage, particularly on food crops.

Crop Yields

2.26 Production data from the farming systems survey need to be reinforced with further yield studies to be undertaken by AES in 1989 and beyond. Indicative yields derived from secondary sources are presented in chapter 14.

2.29 In the survey the following yields were obtained:

Yield data from the farming systems survey

	<u># obs</u>	<u>kg/ha</u>
copra	4	969
cocoa (green beans)	2	561
sweet potato	8	5,930
Taro - Common	2	4,298
Hong Kong	4	8,057
Yam	1	3,889

Labour

2.30 The dominant constraints are on tree crops. A labour shortage is recorded on 63% of the tree crop area, while a shortage of inputs or cash is recorded on 11% of the area. In contrast only 7% of food crop gardens, and on only a small part of the food crop area, have a shortage of labour. Distance of gardens from households is not regarded as a problem except on one food crop garden.

2.31 Labour expenditure on the average holding is summarised in table 2.1 - presented firstly by crop (aggregating all operations), and secondly by operation (aggregating all crops).

Table: 2.1
SUMMARY OF LABOUR INPUT

	<----- work days per year -----> <----- per holding ----->					<- % contribution ->			labour cost (SI\$)
	men	women	paid	total	per ha average	men	women	paid	
i) By Crop									
Cleared Land	1	1		2					
Coconut	186	48	1	235	246	79	20	0	5
Cocoa	38	64		102	601	37	63		1
Grain crops					387				
Vegetable					274				
Fruit Crops					102				
Sweet Potato	51	66		117	981	44	56		
Taro	49	52	1	102	1076	48	51	1	1
Yam	5	1		6	2658	83	17		
Pana	12	4		16	840	75	25		
All Crops	342	236	2	580		59	41	0	7
ii) By Operation									
Land Clearance	86	33	1	120		72	28	1	2
Cultivation	93	81		174		53	47		
Planting	64	29		93		69	31		
Tree Crops Establishment	1			1		100			
Tree Crops Maintenance	31	9	1	41		76	22	2	5
First Weeding	20	17		37		54	46		
Second Weeding	13	7		20		65	35		
Third Weeding	5			5		100			
Harvesting	29	60		89		33	67		
All Operations	342	236	2	580		59	41	0	7
Available labour units	:1.88	1.88							
Days per unit labour	: 182	126	2						

2.32 Overall men provide 59% of labour and women provide 41% of farm labour. There are 580 work days per year required on an "average" holding of which 342 are provided by men, 236 by women and 2 by hired labour. The average adult man in the household spends 182 days working on the holding and the average adult woman spends 126 days.

2.33 Coconut accounts for 41% of the holding labour budget and cocoa accounts for 18%. Sweet potato accounts for 20%, taro 18%, yam 1% and pana 3%. Overall tree crops account for 58% of the annual labour budget and food crops account for 42%.

2.34 Men and women share most operations. Of the annual labour budget of 580 days, land clearance accounts for 21% of labour expended, cultivation accounts for 30%, planting 16%, establishment and maintenance 7%, weeding 10% and harvesting 15%.

Cash Crop Processing

2.35 The labour composition for copra production is 64% family and 36% hired at an annual cash cost of SI\$21.7. Hired labour is employed mainly in collecting nuts while all operations are performed by family labour.

2.36 Copra manufacture requires 114 work days per annum to produce 692kg copra, or one work day per 6kg copra produced. 81 work days are spent on picking and shelling the nuts which account for 71% of the total production time. Firewood collection takes 18 days or 16% of the time; and drying, bagging and transport take 14 days or 13% of the time.

2.37 From an annual production of 692kg valued at the prevailing price of 33 cents per kilo the gross return is SI\$228. Inputs costs from bags and twine amount to SI\$10.20 and labour costs are SI\$21.70. The net income is SI\$196 which, at a requirement of 72 household labour days, represents a net return to labour of SI\$2.72 per household work day.

2.38 13 family work days were expended in the production of 365kg cocoa green beans. An annual production of 365kg of cocoa at the prevailing price of SI\$0.70 per kilo green beans provides a net return of SI\$256, representing a return to labour of SI\$20 per family day worked.

Marketing

2.39 There was no local market and so local crop prices could not be obtained.

2.40 Marketing problems mostly slight, but transport, distance, labour shortage, low prices and risk of not selling enough are all problems.

Chapter: 3

HOUSEHOLD COMPOSITION

3.1 The analysis of household composition in the farming systems survey is to set production and management information in a social context and to establish labour availability. New demographic data are becoming available from the 1986 census and these provide background to survey results. Table 3.1 summarises some early results of the census⁽¹⁾.

Table: 3.1
POPULATION CHARACTERISTICS
(from the 1986 census)

I Province	I Western	Ysabel	Central	Guadal	Honiara	Malaita	Makira	Temotu	I Total	I
I 1986 population	I 55,250	14,616	18,457	49,831	30,413	80,032	21,796	14,781	I 285,176	I
I annual growth rate	I 3.0	3.2	2.9	4.3	6.8	2.7	3.6	2.8	I 3.5	I
I % national population	I 19	5	6	17	11	28	8	5	I 100	I
I peri-urban population	I 3,710	1,901	1,622		30,413	3,252	2,588	1,295	I 44,781	I
I % peri-urban	I 7	13	9	38		4	12	9	I 16	I
I males	I 29,202	7,329	9,850	26,251	17,293	39,605	11,174	7,268	I 147,972	I
I females	I 26,048	7,287	8,607	23,580	13,120	40,427	10,622	7,513	I 137,204	I
I sex-ratio	I 112	101	114	111	132	98	105	97	I 108	I
I number of households	I 7,942	2,362	3,079	8,072	4,317	12,417	3,278	2,375	I 43,842	I
I household size	I 6.96	6.19	5.99	6.17	7.04	6.45	6.65	6.22	I 6.50	I
I Age composition (%)	I								I	I
I 0 - 14	I 46.4	48.8	45.7	46.8	39.2	50.2	50.7	49.6	I 47.3	I
I 15 - 29	I 27.2	22	26	27.2	35.7	21.7	23.3	23.3	I 25.8	I
I 30 - 44	I 13.5	13.9	14.4	14	17.1	13.2	13.1	13.3	I 13.9	I
I 45 - 59	I 8	8.5	8.2	7.3	5.8	9.1	8.2	8.5	I 8.1	I
I 60 +	I 4.9	6.7	5.7	4.6	2.1	5.7	4.6	5.5	I 4.9	I

Source: Statistics Office Statistical Bulletin 3/88

3.2 In November 1986 the population of Solomon Islands was 285,176 with an annual growth rate of 3.5%. The national mean household size was 6.5, resulting in a total of 43,842 households, of which at least 84% are rural. Guadalcanal, Malaita and Western Provinces account for 77% of the national population.

3.3 The age composition of the Solomon Islands population is young with a wide based, tapering population pyramid. The "dependency ratio" (the number of persons under 15 years and over 60 years of age per 100 persons aged 15 to 59 years) is 109⁽²⁾.

3.4 The total fertility rate is 6.4 children per woman at the end of her child bearing age. The life expectancy at birth among males is 59.9 years, and among females is 61.4 years. Male infant mortality is 40 per thousand live births compared with a female infant mortality of 36 per thousand live births⁽²⁾.

3.5 In the census 40,046 persons attended school during 1986, although some disruption was caused by Cyclone Namu. Among all persons aged 5 years and over not attending school in 1986, 51% had no education. Primary school attendance spans a wide age range, but 20% of age group 10 to 24 never attended school.

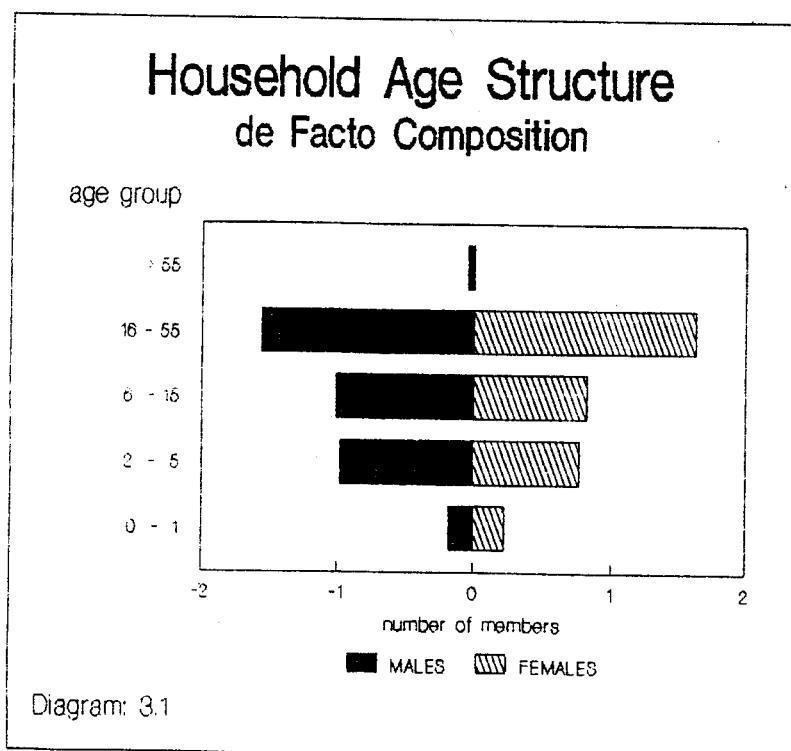
3.6 94.2% of the Solomon Islands population is Melanesian, 3.7% Polynesian and 2.1% other ethnic groups, but mainly Kiribati. 17% of the census population were residing in a province other than that of their birth, indicating a considerable level of internal migration. Onward movement is particularly strong from Malaita, resulting in net out-movement. This is true for provinces other than Central and Guadalcanal which experience a net in-movement. All provinces showed a net movement to Honiara.

3.7 Household composition results from the farming systems survey are summarised in table 3.2. Age categories are chosen to provide approximate conversion into "available labour units". The membership of a household often includes relatives and, less commonly, non-relatives (these are both referred to as "relatives" in the table). Both family and non-family members define the "de facto" household size which is the actual number of people residing in the household, and is illustrated in diagram 3.1. A second measure of household composition is the number of immediate family members (father, mother, sons and daughters) either living at home or living away. This is known as the "de jure" family size.

Table: 3.2
HOUSEHOLD COMPOSITION

Mean Number of Household Members:

MALE					FEMALE				
living at HOME				AGE GROUP	living at HOME				AGE GROUP
Head	Family	Relative	Family		Head	Family	Relative	Family	
0.05	:	:	:	> 55	:	:	:	:	
0.93	0.48	0.15	0.23	16 - 55	1.48	0.15	0.42		
	0.83	0.18		6 - 15	0.82		0.05		
	0.75	0.23		2 - 5	0.67	0.10	0.03		
	0.13	0.05		0 - 1	0.18	0.05			
Category total:	0.98	2.19	0.61	0.23	3.15	0.30	0.50	7.96	
Family at home:		3.17			3.15			6.32	
De Facto total:			3.78			3.45		7.23	
De Jure total :				3.40			3.65	7.05	



3.8 In the survey area the average family size is 7.05. With 10% of family members living away from home, a household has on average 7.23 members, of which 6.32 are immediate family and the remainder relatives or others residing in the household. Of those living away 0.65 are in the economically active age group 16 - 55 and 0.08 are younger than 15 . Of 3.40 male family members 3.17 live at home, representing a net onward movement of 7% among male family members. This is compensated for by non-family male household members, since there are 3.78 males in the household.

3.9 Of 3.65 female family members 3.15 live at home, representing an onward movement of 14% . This is not entirely compensated for by additional non-family female members living in the household since there are 3.45 female members of the household.

3.10 There is then an 11% net inward movement of males and a 5% net out-movement of females. This results in a household gender composition of 3.78 male household members to 3.45 females, a ratio of 1:0.91 males to females.

3.11 Household composition is converted into "adult equivalent labour units" in table 3.3 according to factors employed by Bathgate⁽¹⁸⁾ (although there are slight differences in age classes between the two studies). An average household of 3.76 labour units is made up of 1.88 male units and 1.88 female units, a balance of male and female labour.

Table: 3.3

HOUSEHOLD LABOUR AVAILABILITY

Mean number of members by age group:

<----- MALES ----->			I	AGE	I	<----- FEMALES ----->			<----- TOTAL ----->		
de Jure	de Facto	labour	I	GROUP	I	de Jure	de Facto	labour	de Jure	de Facto	labour
			I		I						
0.05	0.05	0.03	I	> 55	I				0.05	0.05	0.03
1.64	1.56	1.55	I	16 - 55	I	1.90	1.63	1.63	3.54	3.19	3.18
0.83	1.01	0.30	I	6 - 15	I	0.87	0.82	0.25	1.70	1.83	0.55
0.75	0.98		I	2 - 5	I	0.70	0.77		1.45	1.75	
0.13	0.18		I	0 - 1	I	0.18	0.23		0.31	0.41	
			I		I						
Total	3.40	3.78	1.88			3.65	3.45	1.88	7.05	7.23	3.76

Labour availability assumes the following conversion factors:

age class factor

> 55	0.6
16 - 55	1.0
6 - 15	0.3
0 - 5	0.0

Chapter: 4

INCOME EARNING ACTIVITIES

4.1 2.5% of rural households in the country were enumerated in the 1982 Household Income and Expenditure Survey ⁽³⁾ conducted by the Statistics Office of the Ministry of Finance. Virtually all rural households had food gardens. 39% sold copra and 41% sold garden produce, with an average monthly income from sales of SI\$ 56. A summary of income earning activities according to the 1982 survey compared with the 1986 population census is presented in table 4.1.

Table: 4.1

1982 INCOME AND EXPENDITURE SURVEY: SALES

activity	% households earning income	
	1982	1986
copra	39	29
coconut	18	
cocoa	0.38	9
betel nut	1.25	17
other cash crop	12	
garden produce	41	34
cattle		2
pigs		12
poultry		10
fish	24	17
crabs, lobster		4
beche de mer		12
shells	7	
carvings	4	
hand crafts	0.38	4
canoes		3
mats, baskets		10
thatch		4
houses		5
other sales	1.13	

Source: Statistics Office National Accounts Discussion Document No 2
Statistics Office Bulletin 12/88

4.2 These figures show the importance of garden produce sales as an income earning activity, although the relative magnitude of earnings is not known. Copra is the major cash earning commodity, showing an apparent contraction in the proportion of rural sales. Cocoa sales have, in contrast, expanded.

4.3 In the 1982 survey 27% of rural households had at least one member in paid employment, from which the average monthly wage was SI\$103. 16% had their own business and 39% of households had a share in a cooperative (although it is stated that this result should be treated with caution). 10% of households held a loan, with an average monthly repayment of SI\$87, the majority with the Development Bank of Solomon Islands.

4.4 On average a household spent SI\$57 per month on goods and services of which 47%, or SI\$27, was on food. Less frequent expenditures amounted to SI\$5 per month.

4.5 Reported (cash and non-cash) income was SI\$147 compared to monthly expenditures of SI\$131. The average cash component of income amounted to SI\$86 per month compared with expenditures of SI\$74. The excess of 17% in income over expenditure was believed to be due to the underestimation of production costs rather than the true value of rural savings.

4.6 The 1986 census ⁽²⁾ found that 25% of the population aged 14 years and over was working for money (the week before the census enumeration), and about half of those also performed village work such as track clearing and church construction. About 80% of those not engaged in cash employment performed village work.

4.7 35% of males were engaged in cash employment compared with 13% of females. The 1982 Household Income and expenditure survey also states that "generally boys had a better chance of attending school than girls".

4.8 The rural economy is diverse, with a variety of farm and off-farm activities which contribute to household income. Results from the farming systems survey are presented in table 4.2. The table describes the proportion of households undertaking income earning activities in the survey area. Rural income and expenditure patterns are covered by other (non AES) surveys - planned or recently undertaken - and so the present survey does not investigate the relative importance of activities undertaken

in terms of income earned, except in Chapter 19 on marketing.

Table: 4.2

INCOME EARNING ACTIVITIES

	<---- % households ----> by activity		
	individual	group	summary of individual activities
Households Earning Income Over the Past Year From:			
COCONUTS			
Coconuts			
Copra	23	23	+++++++
Coconuts and Copra			
Total	23		
COCOA			
Green beans	5	5	++
Dry Beans			
Green and Dry Beans			
Total	5		
OTHER CROPS			
Food Crops	30	35	+++++
Other Cash Crops	10	13	++++
Food and Cash Crops	3		+
Livestock		3	
Food crops and Livestock	3		+
Cash Crops and Livestock			
Food, Cash Crops and Livestock			
Total	45		
FISHING			
Fish	30	30	+++++
Shellfish			
Fish and shellfish			
Crabs, etc			
Fish and Crabs			
Shellfish and Crabs			
Fish, Shellfish and Crabs			
Total	30		
LOGGING/MINING			
Logging			
Sawmill			
Logging and Sawmill			
Mining			
Logging and Mining			
Sawmill and Mining			
Logging, Sawmill and Mining ..			
Total			

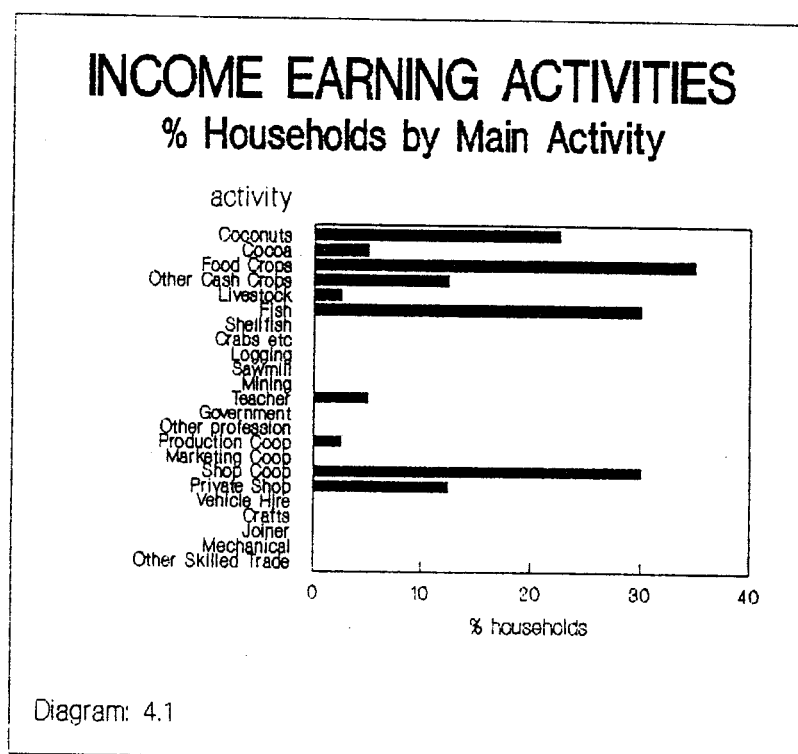
INCOME EARNING ACTIVITIES (continued)

	<---- % households ----> by activity		
	individual	group	summary of individual activities
PROFESSION			
Teacher	5	5	++
Government Employee			
Other Profession			
Total	5		
COOPERATIVE			
Crop Production Cooperative ..	3	3	+
Marketing Cooperative			
Crop and Marketing			
Cooperative Shop	30	30	+++++
Crop and Shop			
Marketing and Shop			
Crop, Marketing and Shop			
Total	33		
BUSINESS			
Private shop	13	13	+++++
Vehicle Hire			
Shop and Vehicle			
Crafts			
Shop and Crafts			
Vehicle and Crafts			
Shop, Vehicle and Crafts			
Total	13		
SKILLED TRADE			
Joiner/housebuilder			
Mechanical Trade			
Joiner and Mechanical			
Other Skilled Trade			
Joiner and Other			
Mechanical and Other			
Joiner, Mechanical and Other .			
Total			

4.9 In the table are two columns, entitled "individual" and "group". Individual activities distinguish between combinations of activities - treating for instance "food crops" (only), "livestock" (only) and both "food crops and livestock" as three distinct activities. The percentages of households for individual activities are additive, and are shown as a "total" for each set of related activities in the table.

4.10 Under group activities - all occurrences of "food crops" and all occurrences of "livestock" are summarised under the two main headings, since "livestock" and "food crops and livestock" are both livestock activities. "Group" activities represent an alternative summary for the data set, and are non additive.

4.11 To the right of table 4.2 is a histogram summary of individual activities. Diagram 4.1 provides a visual summary of grouped activities.



4.12 Agricultural income earning activities in the survey area are mainly the sale of food crops, fishing and the sale of copra. 35% of sampled households earn income from food crop sales, 13% earn income from minor cash crops, and 3% from livestock sales. 30% of households earn income from fishing.

4.13 23% of households earn income from copra and 5% of households earn income from cocoa.

4.14 5% of households (2 households) have a profession in teaching. 13% of sampled households earn income from private shops and 30% of households earn income from cooperative shops.

Chapter: 5

EXTENSION AND MASS MEDIA

5.1 Table 5.1 summarises the penetration of mass media and extension in the survey area.

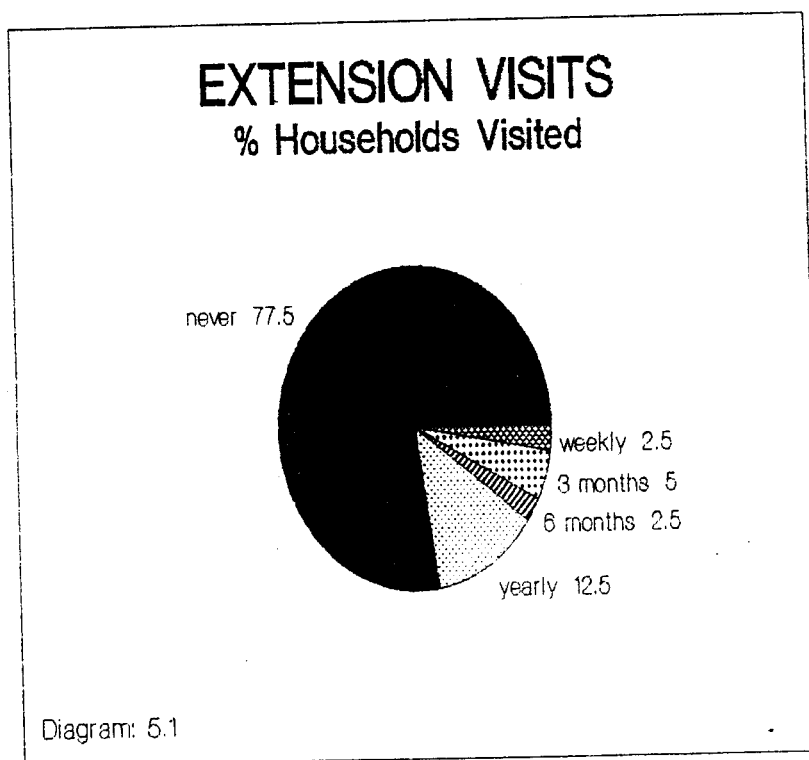
Table: 5.1
EXTENSION AND MASS MEDIA

	% households	summary
i) Households Listening to Agricultural Programmes on the Radio:		
Never listen	33	+++++++
Listen weekly	8	+
" monthly		
" occasionally	60	+++++++
Total	100	
ii) Households with Members who can Read and Write:		
Not able to read or write	15	+++
Able to read		
" write		
" read and write	85	+++++++
	100	
iii) Households Visited by (any type of) Extension Worker:		
Never been visited	78	+++++++
Visited very occasionally		
" once per year	13	+++
" " 6 months	3	.
" " 3 months	5	+
" " month		
" " week	3	.
Don't know		
	100	
iv) Households in which Members have Attended Training:		
Never attended training	70	+++++++
Attended village meeting	13	+++
" day course at training centre	13	+++
" village meeting and day course		
" residential course	5	+
" village meeting and residential course		
" day and residential course		
" village meeting, day and residential course ...		
	100	
	100	

5.2 Travel and communication are difficult in Solomon Islands, with scattered islands of low population densities. Radio offers a means of transmitting information throughout the country, albeit one-way, and in a medium which makes few demands on literacy. In the survey 67% of households listen to agricultural programmes on the radio, although mostly only occasionally. The communication of agricultural and other development information by radio may be extended further by word of mouth.

5.3 The second part of the table shows the proportion of households in which at least one member is able to read or write. According to these results 85% of households have at least one member with some reading and writing skills. The survey was unable to verify the level of skills or to substantiate this finding objectively, but the result suggests that simple written materials are an appropriate extension medium. In more general terms, pictorial materials would be popular together with simple text and annotation.

5.4 The frequency of extension visits is investigated in the third part of the table, and is illustrated in diagram 5.1.



5.5 Extension in the present study refers to any agricultural worker in government extension, research, NGOs or other organisations. 22% of households are visited at least once per year and 30% have received some form of agricultural training, mainly in the form of village meetings and day courses.

Chapter: 6

LIVESTOCK

6.1 Livestock, particularly small stock such as pigs and chickens, are an important feature of smallholder agriculture in Solomon Islands.

6.2 The number of cattle in the 1985 census was 19,750 - a fall of 13.1% from 1984 due largely to destocking in the plantation sector. Overall the national herd was 22% below its peak of 1978, with an average annual fall of 3.4%⁽⁴⁾.

6.3 The smallholder sector accounted for 7,612 cattle, 39% of the national herd, showing a decline of 4.1% from the 1984 census. The distribution of cattle throughout the country is shown in table 6.1.

Table: 6.1
CATTLE DISTRIBUTION IN 1985

Province	total cattle	% distribution
Western	4,841	25
Ysabel	1,110	6
Central	2,081	10
Guadalcanal	6,292	32
Malaita	3,810	19
Makira	1,462	7
Temotu	217	1
Total	19,750	100

Source: Statistics Office, 1985 Cattle Census

6.4 In the 1982 Income and Expenditure Survey⁽³⁾ it was found that 37% of households owned pigs, 30% owned chickens, but only 8% owned cattle. The provincial breakdown is shown in table 6.2.

6.5 According to the 1986 Population Census⁽²⁾ 2% of households earned income from cattle, 12% earned income from pigs and 10% earned income from poultry.

Table: 6.2
LIVESTOCK DISTRIBUTION IN 1982

Province	% households owning		
	cattle	pigs	chickens
Western	2	19	24
Ysabel	42	25	47
Central		28	7
Guadalcanal	2	63	41
Malaita	9	35	28
Nakira	10	69	63
Temotu		40	4
Total	8	37	30

Source: Statistics Office, 1982 HH Income and Expenditure Survey

6.6 3% of households earned income from livestock (table 4.2) sales.

6.7 Table 6.3 summarises livestock ownership in the survey area, and is divided into three columns. The first, entitled "ownership %", specifies the percentage of households which own livestock. The middle two columns show mean stock held: firstly among livestock owning households (owners); and secondly as an average of all farmers in the survey area (both owners and non-owners). To the right of the table is a histogram summary of ownership based on the mean among all farmers.

6.8 The table is divided horizontally into three main parts. The first part specifies stock numbers kept predominantly for home use, but which may include occasional sales. The second part specifies stock numbers where livestock comprise an income earning enterprise. The third part is the overall mean of livestock ownership irrespective of type of enterprise. (Note that overall mean ownership figures are derived from the original data and may not be obtained from summation of the table entries above).

6.9 At the foot of the table is a component on novel livestock enterprises, such as bees, butterflies and crocodile farming, however, these were not encountered in the survey.

Table: 6.3
LIVESTOCK

Livestock Ownership:

	ownership %	<-- mean ownership among -->		
		owners	all farmers	summary all farmers
i) Home Use				
Cattle	3	1.00	0.03	.
Pigs	43	1.24	0.53	++
Goats	3	1.00	0.03	.
Chickens	50	9.95	4.97	+++++
Ducks	5	5.00	0.25	+

Horses

ii) Commercial

Cattle
Pigs
Goats
Chickens
Ducks

Horses

iii) Total

Cattle	3	1.00	0.03	.
Pigs	43	1.24	0.53	++
Goats	3	1.00	0.03	.
Chickens	50	9.95	4.97	+++++
Ducks	5	5.00	0.25	+

Horses

iv) Households Earning Income

	<---- % households ---->	
	by activity	
	individual	group

Income from:

1. Bees or honey
2. Butterflies
3. Bees and Butterflies
4. Crocodiles
5. Bees and crocodiles
6. Butterflies and crocodiles
7. Bees, butterflies and crocodiles ..

6.10 There is a very low level of commercialism in the management of livestock in N W Peninsula. Only one sampled farmer has a cow and the most important livestock are pigs and chickens.

6.11 Pigs play an important role in the custom and life of rural households. They are kept mainly for ceremonial feasts, weddings and funerals, and other social gatherings. 43% of farmers keep pigs with a mean herd size of 1.24 among owners.

6.12 Pigs are generally fenced behind the village, or penned over the tidal shore line. Fences are commonly made of wood or stone and a shelter of sago palm may be built inside the enclosure. Pigs inside will be fed in the morning and evening and watered where necessary. Pigs will be fed with sweet potato and coconut, fruits and leaves.

6.13 Chickens and ducks are largely kept for food and are especially important at Christmas time and at birthdays. They are allowed to free range, requiring minimal management. Chickens are kept by 50% of households with a mean flock size of 9.95 among owners. 5% of households keep ducks with a mean flock size of 5.

Chapter: 7

HOLDING SIZE DISTRIBUTION

7.1 Holding size distribution is of interest because it provides an understanding of the structure of agriculture and may help to explain constraints faced by farmers or response to services.

7.2 Table 7.1.i describes the holding size distribution of the survey area. Holdings are reasonably large, but a high proportion of farmers have relatively small areas. With a mean holding size of 1.386ha, 72% of farmers have holdings smaller than the mean size. This can be seen in diagram 7.1 which shows that inequality in the holding size distribution arises largely because a high proportion of farmers fall in the very low holding size class of 0 to 0.25ha.

7.3 The mean describes the "average" holding size and is of interest in that it provides a value for the "middle" of the data based on the spread of values, but it may be misleading when unbalanced extreme values occur. Another measure of central tendency is the median which is the "mid-point" in the data, the value of the middle item when the data are arranged in order. In a "normal distribution" the median and the mean coincide. The median in this case is 0.647ha which is appreciably lower than the mean holding size.

7.4 An indicator of variability is the range, which is derived from extremes in the data. The minimum area is 0.062ha and the maximum is 9.334ha, a range of 9.272ha.

7.5 The standard deviation is a measure of variation based on the extent to which values deviate from the mean. If the data are closely bunched the standard deviation is small, and if they are widely spread it is large. In a normal distribution 68% of values lie within 1 standard deviation on either side of the mean, and 95% within 2 standard deviations. In the survey results the mean of 1.386ha has a standard deviation of 1.960 and a coefficient of variation of 141% (the standard deviation expressed as a percentage of the mean).

7.6 Skewness is an index of symmetry in the data. A normal distribution is symmetrical about the mean, with a skewness coefficient of zero, whereas a skewed distribution has a longer "tail" on one side than the other. The present data have a skewness of 2.642 indicating only slightly positive skewness.

7.7 Kurtosis is the extent to which the data cluster around a central point. When this occurs the distribution appears "peaked". Positive values of kurtosis indicate that the distribution is more peaked than normal. In the present data set the coefficient of kurtosis is fairly low, being 7.674.

7.8 The indications are that there is inequality in holding size distribution, since a high proportion of farmers have very small holdings while a few have relatively large holdings. The holding size distribution may be viewed in standard form in diagram 7.2. The diagonal represents the holding size distribution for equality and the curve below represents the actual (cumulative) holding size distribution. The area between the diagonal and the curve is the "area of inequality". The larger the area of inequality, the more unequal the holding size distribution. This may be expressed as an index, called the "Gini coefficient", which is the area between the two lines expressed as a proportion of the area of the triangle below the diagonal. The Gini coefficient ranges from 0 (for perfect equality) to 1 (for perfect inequality). The Gini coefficient here is 0.602, indicating a fairly high degree of inequality.

Table: 7.1

HOLDING SIZE DISTRIBUTION

i) All holdings and all crops

holding size (ha)	number of holdings	mean area in class (ha)	total area in size class (ha)	<----- % ----->		<-- cumulative % -->	
				holdings	area	holdings	area
0 - .25	12	0.1604	1.92	31	4	31	4
.25 - .5	3	0.3353	1.01	8	2	38	5
.5 - .75	5	0.5778	2.89	13	5	51	11
.75 - 1	5	0.8524	4.26	13	8	64	19
1 - 1.25	3	1.1224	3.37	8	6	72	25
1.25 - 1.5	1	1.4065	1.41	3	3	74	27
1.5 - 1.75	1	1.6818	1.68	3	3	77	31
1.75 - 2						77	31
2 - 2.5	2	2.1491	4.30	5	8	82	39
2.5 - 3	2	2.7088	5.42	5	10	87	49
3 - 5	2	3.2246	6.45	5	12	92	60
5 - 10	3	7.1218	21.37	8	40	100	100
10 - highest						100	100
Total	39	1.3863	54.07	100	100		

Mean	1.386	S.E. Mean	0.314
Median	0.647	Coef. of Var %	141
Std Dev	1.960	Variance	3.841
Kurtosis	7.674	S.E. Kurtosis	0.741
Skewness	2.642	S.E. Skewness	0.378
Range	9.272	Minimum	0.062
Maximum	9.334	Sum	54.068
Gini	0.602		

Note that the main table is a frequency distribution of grouped intervals, while the statistics at the foot of the table describe the ungrouped data set.

HOLDING SIZE DISTRIBUTION

all holdings - all crops

holding size (ha)

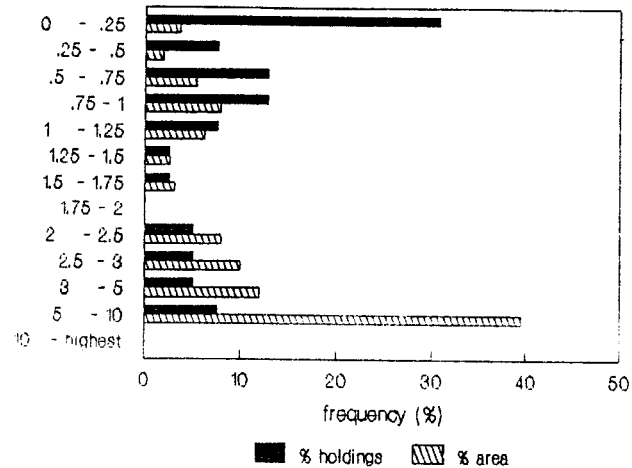


Diagram: 7.1

LORENZ CURVE

all holdings - all crops

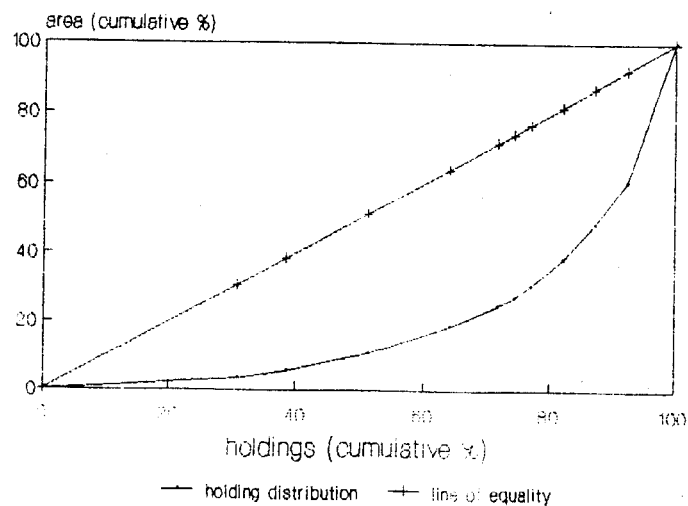


Diagram: 7.2

7.9 Table 8.1.ii shows the holding size distribution of only those farmers who have tree crops. The sample is reduced from 39 to 25, and so the stratum of farmers with tree crops represents 64% of all farmers in the sample.

7.10 The mean holding size among tree cropping farmers is 2.040ha and the median is 1.120ha. The coefficient of skewness remains much the same at 2.158 and kurtosis has fallen slightly to 4.793. The range remains wide, but the majority of small holdings are excluded so that the distribution is less scattered, with a coefficient of variation of 108%.

ii) Holdings with tree crops

holding size (ha)	number of holdings	mean area in class (ha)	total area in size class (ha)	<----- % -----> holdings area		<-- cumulative % --> holdings area	
0 - .25	1	0.2051	0.21	4	0	4	0
.25 - .5	1	0.2552	0.26	4	1	8	1
.5 - .75	4	0.5747	2.30	16	5	24	5
.75 - 1	5	0.8524	4.26	20	8	44	14
1 - 1.25	3	1.1224	3.37	12	7	56	20
1.25 - 1.5	1	1.4065	1.41	4	3	60	23
1.5 - 1.75	1	1.6818	1.68	4	3	64	26
1.75 - 2						64	26
2 - 2.5	2	2.1491	4.30	8	8	72	35
2.5 - 3	2	2.7088	5.42	8	11	80	45
3 - 5	2	3.2246	6.45	8	13	88	58
5 - 10	3	7.1218	21.37	12	42	100	100
10 - highest						100	100
Total	25	2.0403	51.01	100	100		
Mean	2.040			S.E. Mean		0.440	
Median	1.120			Coef. of Var %		108	
Std Dev	2.198			Variance		4.830	
Kurtosis	4.793			S.E. Kurtosis		0.902	
Skewness	2.158			S.E. Skewness		0.464	
Range	9.129			Minimum		0.205	
Maximum	9.334			Sum		51.007	
Gini	0.487						

7.11 The new distribution of farmers with tree crops is illustrated in diagram 7.3, and its associated Lorenz curve in diagram 7.4. Inequalities have been slightly reduced by excluding the smaller holdings and the holding size distribution is more "normal" with a Gini coefficient of 0.487.

HOLDING SIZE DISTRIBUTION

holdings with tree crops

holding size (ha)

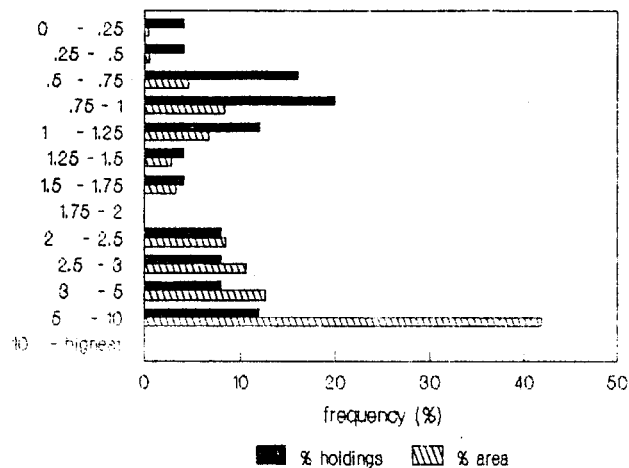


Diagram: 7.3

LORENZ CURVE

holdings with tree crops

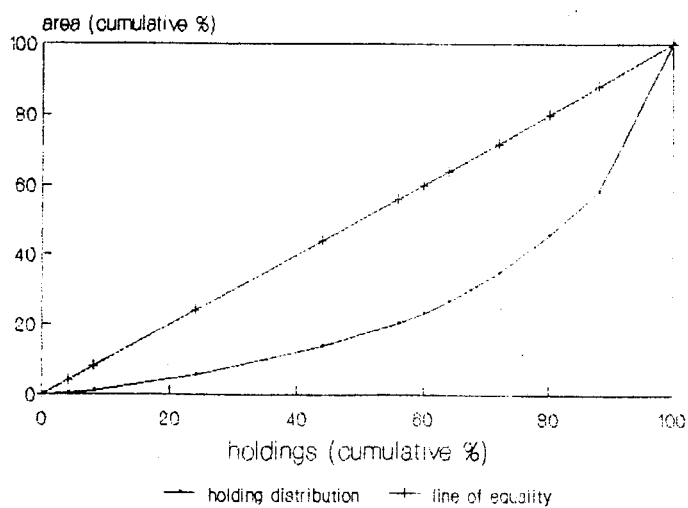


Diagram: 7.4

7.12 The corresponding stratum of farmers with no tree crops is shown in table 7.1.iii. 14 farmers, or 36% of the sample have no tree crops. The mean holding size is 0.219ha and the median is 0.180. The range is small, skewness has dropped to 1.601 and kurtosis has dropped slightly to 2.630. The distribution is more "normal", with a coefficient of variation of 65%.

7.13 The holding size distribution is illustrated in diagram 7.5, and its associated Lorenz curve in diagram 7.6. Inequality is low with a Gini coefficient of 0.313.

iii) Holdings without tree crops

holding size (ha)	number of holdings	mean area in class (ha)	total area in size class (ha)	<----- % -----> holdings area		<-- cumulative % --> holdings area	
0 - .1	2	0.0798	0.16	14	5	14	5
.1 - .2	5	0.1373	0.69	36	22	50	28
.2 - .3	4	0.2185	0.87	29	29	79	56
.3 - .4	1	0.3432	0.34	7	11	86	67
.4 - .5	1	0.4074	0.41	7	13	93	81
.5 - .6	1	0.5903	0.59	7	19	100	100
.6 - .7						100	100
.7 - .8						100	100
.8 - .9						100	100
.9 - 1						100	100
1 - 1.5						100	100
1.5 - 2						100	100
2 - highest						100	100
Total	14	0.2186	3.06	100	100		
Mean	0.219			S.E. Mean		0.038	
Median	0.180			Coef. of Var %		65	
Std Dev	0.142			Variance		0.020	
Kurtosis	2.630			S.E. Kurtosis		1.154	
Skewness	1.601			S.E. Skewness		0.597	
Range	0.528			Minimum		0.062	
Maximum	0.590			Sum		3.061	
Gini	0.313						

Note the smaller size classes in this table with respect to previous tables.

HOLDING SIZE DISTRIBUTION

holdings without tree crops

holding size (ha)

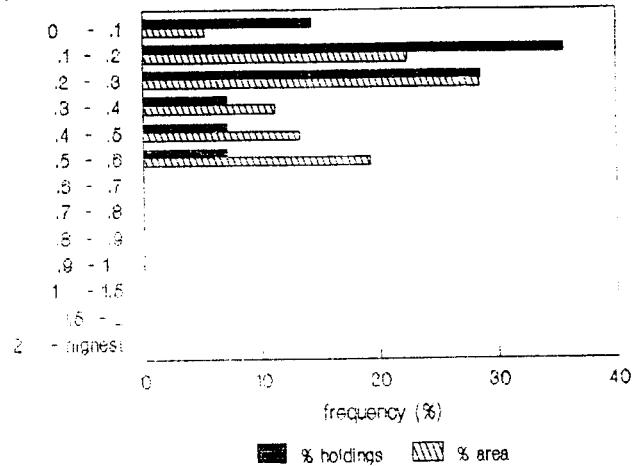


Diagram: 7.5

LORENZ CURVE

holdings without tree crops

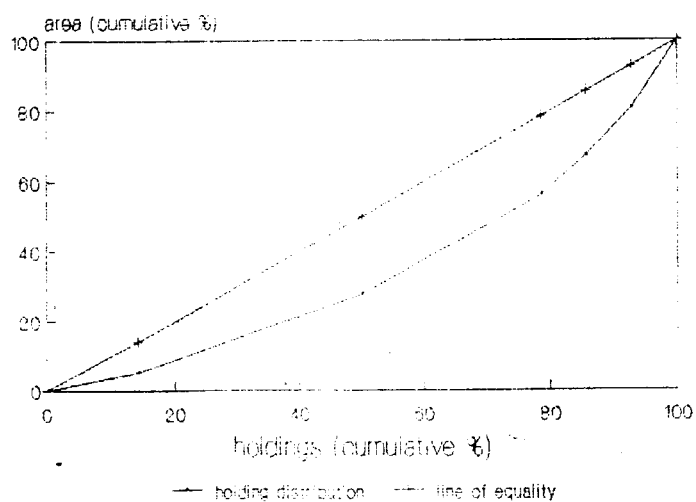


Diagram: 7.6

7.14 Table 7.1.iv describes the holding size distribution of all farmers, but excluding tree crop areas. The holding size distribution is illustrated in diagrams 7.7 and 7.8. These results are similar to those for non-tree crop farmers, indicating that subsistence cropping is similar among all farmers with a mean area of 0.262ha.

iv) All holdings - total area excluding tree crops

holding size (ha)	number of holdings	mean area in class (ha)	total area in size class (ha)	<----- % -----> holdings area		<-- cumulative % --> holdings area	
0 - .1	2	0.0798	0.16	5	2	5	2
.1 - .2	13	0.1458	1.90	34	19	39	21
.2 - .3	11	0.2332	2.57	29	26	68	46
.3 - .4	6	0.3526	2.12	16	21	84	68
.4 - .5	3	0.4240	1.27	8	13	92	81
.5 - .6	1	0.5903	0.59	3	6	95	86
.6 - .7	1	0.6237	0.62	3	6	97	93
.7 - .8	1	0.7190	0.72	3	7	100	100
.8 - .9						100	100
.9 - 1						100	100
1 - 1.5						100	100
1.5 - 2						100	100
2 - highest						100	100
Total	38	0.2616	9.94	100	100		
Mean	0.262			S.E. Mean		0.025	
Median	0.227			Coef. of Var %		58	
Std Dev	0.151			Variance		0.023	
Kurtosis	1.626			S.E. Kurtosis		0.750	
Skewness	1.328			S.E. Skewness		0.380	
Range	0.657			Minimum		0.062	
Maximum	0.719			Sum		9.941	
Gini	0.289						

HOLDING SIZE DISTRIBUTION

all holdings excluding tree crops

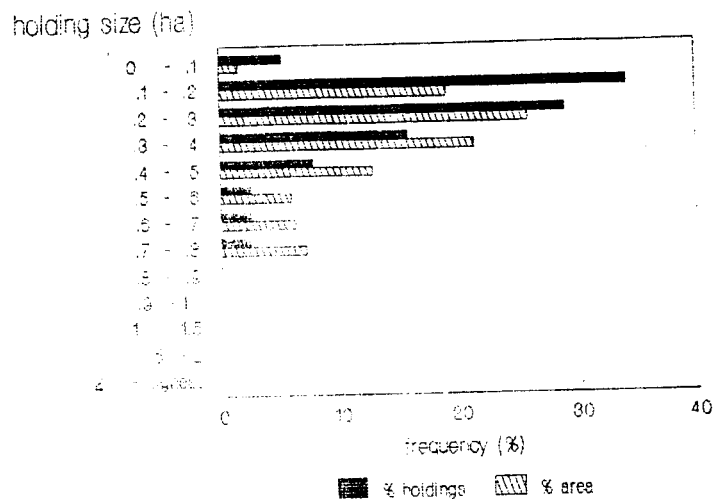


Diagram: 7.7

LORENZ CURVE

all holdings excluding tree crops

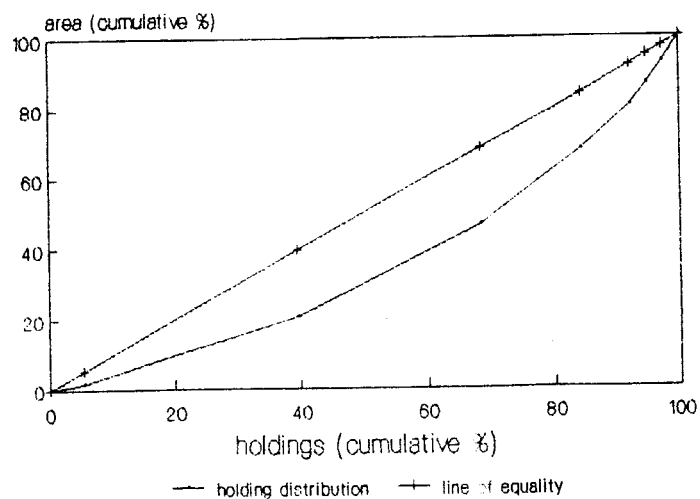


Diagram: 7.8

7.15 Table 7.1.v describes the size distribution of tree crop areas, illustrated in diagrams 7.9 and 7.10.

v) All holdings - total area of tree crops only

holding size (ha)	number of holdings	mean area in class (ha)	total area in size class (ha)	<----- % -----> holdings	<----- % -----> area	<-- cumulative % --> holdings	<-- cumulative % --> area
0 - .25	2	0.1619	0.32	8	1	8	1
.25 - .5	5	0.3217	1.61	20	4	28	4
.5 - .75	5	0.5921	2.96	20	7	48	11
.75 - 1	1	0.8028	0.80	4	2	52	13
1 - 1.25	2	1.0385	2.08	8	5	60	18
1.25 - 1.5	1	1.4896	1.49	4	3	64	21
1.5 - 1.75						64	21
1.75 - 2	2	1.8892	3.78	8	9	72	30
2 - 2.5	1	2.3471	2.35	4	5	76	35
2.5 - 3	3	2.6631	7.99	12	18	88	53
3 - 5	1	4.8430	4.84	4	11	92	64
5 - 10	2	7.9536	15.91	8	36	100	100
10 - highest						100	100
Total	25	1.7651	44.13	100	100		

Mean	1.765	S.E. Mean	0.441
Median	0.803	Coef. of Var %	125
Std Dev	1.206	Variance	4.865
Kurtosis	5.223	S.E. Kurtosis	0.902
Skewness	2.248	S.E. Skewness	0.464
Range	9.105	Minimum	0.119
Maximum	9.224	Sum	44.127
Gini	0.559		

7.16 Indicators of variability are again high indicating that variability in holding size is largely accounted for by inequalities in tree cropping.

HOLDING SIZE DISTRIBUTION

all holdings - tree crops only

holding size (ha)

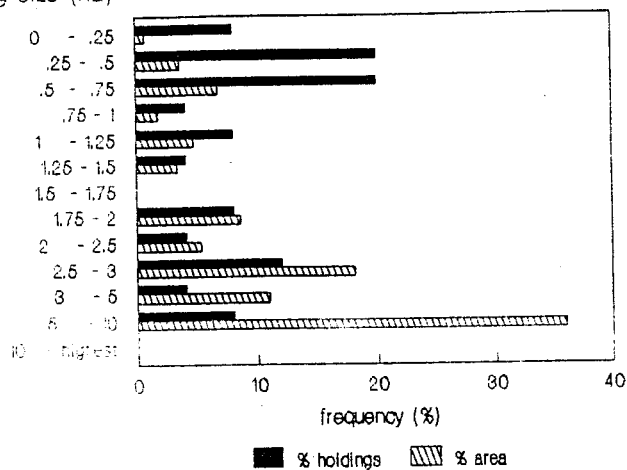


Diagram: 7.9

LORENZ CURVE

all holdings - tree crops only

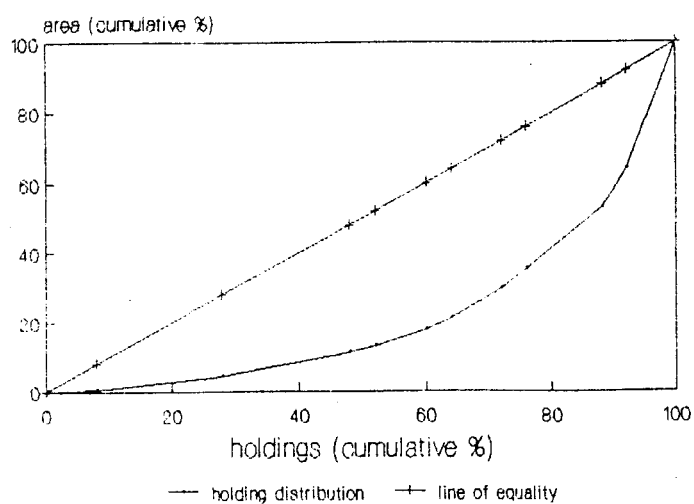


Diagram: 7.10

Chapter: 8

LABOUR DENSITY

8.1 According to Bathgate⁽¹⁸⁾ "increments in the population of a household do not result in an expansion in the garden area. Instead, the garden area holds constant and ... the actual area per consumption and labour unit decreases ... Although there is a variation ... the average household ... tends to clear a fairly similar amount of land for gardens and plant a similar area of root crops". Bathgate postulates that there is no relationship between household size and food garden area. Larger family sizes are not then associated with larger holdings, and he attributes this to a tendency among subsistence producers to cultivate in excess of household requirements as insurance against crop failure.

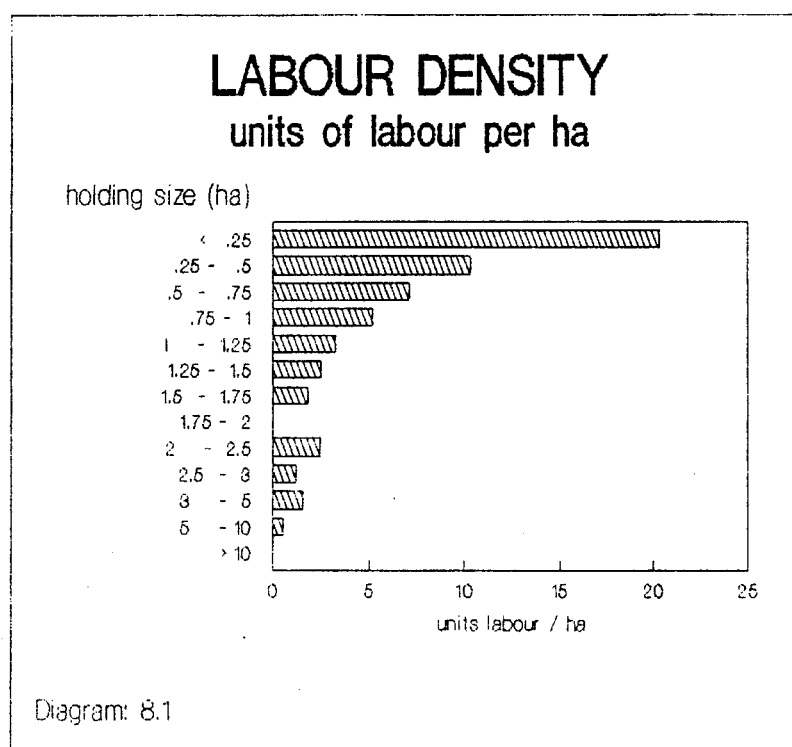
8.2 In the present survey the area of food crops is found to be relatively constant in comparison to a variable tree crop area. Table 8.1 shows the relationship between holding size and labour availability.

Table: 8.1
LABOUR DENSITY - ALL HOLDINGS

holding size class (ha)	:	units of labour	mean holding area (ha)	labour density (labour/ha)	number of observations
all holdings	:	3.80	1.39	2.74	39
< .25	:	3.26	0.16	20.31	12
.25 - .5	:	3.47	0.34	10.34	3
.5 - .75	:	4.12	0.58	7.13	5
.75 - 1	:	4.40	0.85	5.16	5
1 - 1.25	:	3.63	1.12	3.24	3
1.25 - 1.5	:	3.50	1.41	2.49	1
1.5 - 1.75	:	3.00	1.68	1.78	1
1.75 - 2	:				
2 - 2.5	:	5.25	2.15	2.44	2
2.5 - 3	:	3.25	2.71	1.20	2
3 - 5	:	4.95	3.22	1.54	2
5 - 10	:	3.90	7.12	0.55	3
> 10	:				

8.3 There is no apparent relationship between holding size and available labour. Results are in agreement with Bathgate's findings since labour density falls rapidly from 20.31 adult units per hectare for the smallest holding class (less than 0.25ha) to 0.55 units in the largest (5-10ha) class. Small holdings then have a very high labour density while the larger holdings have a low labour density, as seen in diagram 8.1.

8.4 Labour densities are high on small holdings, and with a mean of 2.74 labour units per hectare labour is unlikely to be limiting except on larger holdings.



8.5 Holdings without tree crops are shown in table 8.2.

Table: 8.2

LABOUR DENSITY - NON-TREE CROP HOLDINGS

I	holding	:	units	mean	labour	number	I
I	size class	:	of	holding	density	of	I
I		:	labour	area		observations	I
I	(ha)	:		(ha)	(labour/ha)		I
I	all holdings	:	3.49	0.22	15.95	14	I
I	< .25	:	3.37	0.16	21.56	11	I
I	.25 - .5	:	3.40	0.38	9.06	2	I
I	.5 - .75	:	4.90	0.59	8.30	1	I
I	.75 - 1	:					I
I	1 - 1.25	:					I
I	1.25 - 1.5	:					I
I	1.5 - 1.75	:					I
I	1.75 - 2	:					I
I	2 - 2.5	:					I
I	2.5 - 3	:					I
I	3 - 5	:					I
I	5 - 10	:					I
I	> 10	:					I

8.6 The range of holding size is much smaller and the mean labour density is 15.95 labour units per hectare. The largest holdings of up to 0.75ha in size have a labour availability of 8.30 units per hectare. All holdings have a high labour density.

8.7 Holdings with tree crops are shown in table 8.3.

Table: 8.3
LABOUR DENSITY - TREE CROP HOLDINGS

I	holding	:	units	mean	labour	number	I
I	size class	:	of	holding	density	of	I
I	(ha)	:	labour	area	(labour/ha)	observations	I
I	all holdings	:	3.97	2.04	1.95	25	I
I	< .25	:	2.00	0.21	9.75	1	I
I	.25 - .5	:	3.60	0.26	14.11	1	I
I	.5 - .75	:	3.93	0.57	6.83	4	I
I	.75 - 1	:	4.40	0.85	5.16	5	I
I	1 - 1.25	:	3.63	1.12	3.24	3	I
I	1.25 - 1.5	:	3.50	1.41	2.49	1	I
I	1.5 - 1.75	:	3.00	1.68	1.78	1	I
I	1.75 - 2	:					I
I	2 - 2.5	:	5.25	2.15	2.44	2	I
I	2.5 - 3	:	3.25	2.71	1.20	2	I
I	3 - 5	:	4.95	3.22	1.54	2	I
I	5 - 10	:	3.90	7.12	0.55	3	I
I	> 10	:					I

8.8 There is no apparent relationship between holding size and labour availability. The mean labour density is 1.95 units per hectare, falling off from 9.75 units per hectare on the smaller holdings to 0.55 units per hectare on the holding of 3 to 5ha in size.

8.9 Holdings are not especially small and on most holdings there is unlikely to be a significant constraint to agricultural development in terms of labour availability.

8.7 Holdings with tree crops are shown in table 8.3.

Table: 8.3
LABOUR DENSITY - TREE CROP HOLDINGS

holding size class (ha)	:	units of labour	mean holding area (ha)	labour density (labour/ha)	number of observations
all holdings	:	3.97	2.04	1.95	25
< .25	:	2.00	0.21	9.75	1
.25 - .5	:	3.60	0.26	14.11	1
.5 - .75	:	3.93	0.57	6.83	4
.75 - 1	:	4.40	0.85	5.16	5
1 - 1.25	:	3.63	1.12	3.24	3
1.25 - 1.5	:	3.50	1.41	2.49	1
1.5 - 1.75	:	3.00	1.68	1.78	1
1.75 - 2	:				
2 - 2.5	:	5.25	2.15	2.44	2
2.5 - 3	:	3.25	2.71	1.20	2
3 - 5	:	4.95	3.22	1.54	2
5 - 10	:	3.90	7.12	0.55	3
> 10	:				

8.8 There is no apparent relationship between holding size and labour availability. The mean labour density is 1.95 units per hectare, falling off from 9.75 units per hectare on the smaller holdings to 0.55 units per hectare on the holding of 3 to 5ha in size.

8.9 Holdings are not especially small and on most holdings there is unlikely to be a significant constraint to agricultural development in terms of labour availability.

Chapter: 9

CROPPING PATTERNS

9.1 A "holding" is taken here to be the total area cultivated by a household. It includes all crops growing and land cleared, but does not include fallow which the family may have rights to cultivate.

9.2 A holding is divided into one or more "gardens", which are contiguous blocks of land growing similar crops. Only broad distinctions are made among crop types in gardens.

9.3 A garden may be subdivided into "plots" which are blocks within each garden growing a different crop mix, under different management, or planted at different times. Within plots detailed crop mixtures are recorded.

9.4 Table 9.1 describes cropping patterns at the garden level, maintaining the distinction between farmers with tree crop gardens and those without. A tree crop garden is taken to be a garden in which one or more plots have coconut or cocoa as the dominant crop.

9.5 Tree crop farmers have a mean holding size of 2.05ha, of which 1.77ha is tree crops and 0.28ha food crops. In contrast, non-tree crop farmers have a mean holding size of 0.22ha.

9.6 Tree cropping farmers tend to have more complex holdings, with an average of 3.20 gardens and 6.04 plots compared with 1.71 gardens and 4.00 plots among non-tree crop farmers.

9.7 Table 9.2 describes cropping patterns in more detail. This is derived from the aggregation of plot information in which complex mixtures are summarised by the dominant crop.

9.8 9 major crop mixture classes are listed in table 9.2, predominantly coconuts and cocoa and root crops.

Table: 9.1
CROP COMPOSITION

i) All holdings

crop category	mean area in holding (ha)	mean no gardens per holding	mean no plots per holding	mean no plots per garden	summary of crop area
cleared land					
tree crops	1.13	0.79	1.03	1.30	+++++++
short term cash crops					
food crops	0.25	1.87	4.28	2.29	++
total	1.38	2.66	5.31	2.00	

number of observations = 39

ii) Holdings with tree crops

crop category	mean area in holding (ha)	mean no gardens per holding	mean no plots per holding	mean no plots per garden	summary of crop area
cleared land					
tree crops	1.77	1.24	1.60	1.29	+++++
short term cash crops					
food crops	0.28	1.96	4.44	2.27	++
total	2.05	3.20	6.04	1.89	

number of observations = 25

iii) Holdings without tree crops

crop category	mean area in holding (ha)	mean no gardens per holding	mean no plots per holding	mean no plots per garden	summary of crop area
cleared land					
tree crops					
short term cash crops					
food crops	0.22	1.71	4.00	2.34	++
total	0.22	1.71	4.00	2.34	

number of observations = 14

Table: 9.2
CROPPING PATTERNS

main crop in mixture	all farmers		<----- farmers with ----->			
			no tree crops		tree crops	
	<-- area -->		<-- area -->		<-- area -->	
	(ha)	%	(ha)	%	(ha)	%
a Cleared Land	0.017	1	0.024	11	0.014	1
b Coconut	0.959	69			1.497	73
c Cocoa	0.170	12			0.265	13
z Coconut and Cocoa						
d Pasture						
e Grain Crops	0.001	0			0.002	0
f Beans						
g Cabbage						
h Vegetables	0.001	0			0.001	0
i Spices						
j Fruit Crops	0.004	0			0.007	0
k Fruit trees						
l Banana						
m Citrus trees						
n Nut trees						
o Sugar cane						
p Food/building tree						
q Tobacco						
r Sweet Potato	0.120	9	0.121	55	0.119	6
s Taro	0.094	7	0.060	27	0.112	6
t Yam	0.003	0	0.001	1	0.004	0
u Pana	0.018	1	0.014	6	0.020	1
v Cassava						
w Other root crop						
I						I
I Total mean area (ha)	1.386		0.219		2.040	I
I						I
I Number of households	39		14		25	I
I						I

9.9 The spatial dominance of coconuts is seen clearly in diagrams 9.1 to 9.3 where coconuts account for 69% of the cropped area

9.10 Table 9.2 is still a simplification of cropping patterns found in the field. Table 9.3 describes in more detail the crop mixtures grown by farmers. This no longer applies to a "model" holding but, in aggregate, detailed cropping patterns may be used to determine proportional areas under crop mixtures. Mixtures are listed hierarchically to the left of the table according to the relative dominance of each crop in the mixture. The three main crops are listed by name and any further crops are referred to by code letters. The column of "mean plot area" records the mean area of plots measured in the field according to the number of observations shown in the next column to the right. The column on the far right is the proportional area by crop mixture.

9.11 Crop mixtures illustrate the complexity of smallholder farming systems, in which 67 distinct mixtures are recorded. Small areas of vegetable and short term cash crops, together with a variety of tree crops, are typically scattered among food gardens.

9.12 Table 9.4 summarises tree cropping. The table is in two parts, first showing the average number of trees and second the number of observations on which they are based. Each table is subdivided horizontally into cultivated garden and fallow, and vertically by garden type.

9.13 The averages in the top table are based on all plots (not only the plots in which trees are grown). In the far right column of the lower table is listed the number of observations for which trees are too numerous to count. These are excluded from the averages in the upper table.

CROPPING PATTERNS

all farmers

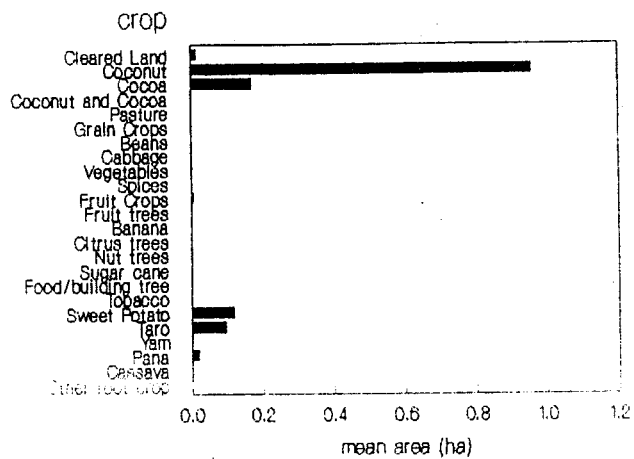


Diagram: 9.1

CROPPING PATTERNS

farmers with no tree crops

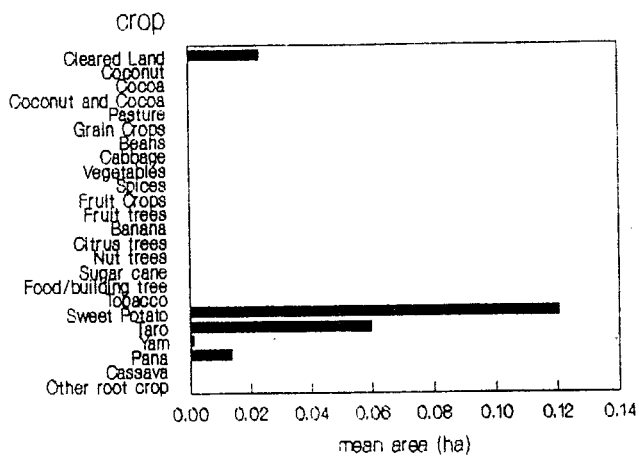


Diagram: 9.2

CROPPING PATTERNS

farmers with tree crops

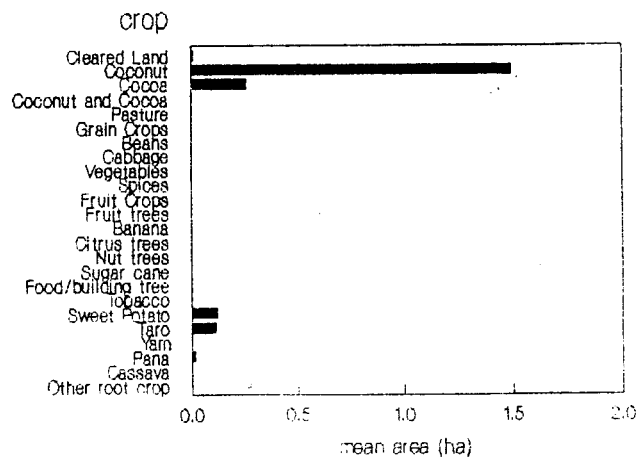


Diagram: 9.3

Table: 9.3
DETAILED CROPPING PATTERNS

<----- main crop in mixture ----->				minor	mean	number	%	%
crop	<----- crop name ----->			mixture	plot	of	plots	area
code	first	second	third	code	area (ha)	plots		
TOTAL					0.0369	207	100	100
a	Cleared land				0.0510	13	6	1.225
b	Coconut				1.6158	22	11	65.74
		Cocoa			0.6246	3	1	3.465
c	Cocoa				0.6873	8	4	10.16
		Coconuts			0.3746	3	1	2.078
e	Grain crops	Vegetable	Fruit crops	lo	0.0170	1	0	0.031
		Banana			0.0194	1	0	0.035
h	Vegetable				0.0036	1	0	0.006
		Fruit crops			0.0052	1	0	0.009
		Banana	Fruit crops	g	0.0115	1	0	0.021
j	Fruit crops				0.0874	2	1	0.323
r	Sweet potato				0.0617	42	20	4.790
		Coconut	Banana	st	0.2867	1	0	0.530
		Cocoa	Grain crops	sgb	0.0486	1	0	0.089
		Grain crops			0.0383	5	2	0.354
			Yam	g	0.0319	1	0	0.058
			Cassava	h	0.0446	1	0	0.082
		Beans	Cabbage	s	0.0142	1	0	0.026
		Cabbage			0.0501	1	0	0.092
		Vegetable	Banana		0.0536	1	0	0.099
		Fruit crops	Beans		0.0686	1	0	0.126
		Banana			0.0292	2	1	0.107
			Vegetable		0.0292	1	0	0.054
			Taro	jh	0.1597	1	0	0.295
			Cassava	h	0.1574	1	0	0.291
				o	0.0294	1	0	0.054
		Taro			0.0402	1	0	0.074
			Vegetable	lvq	0.0774	1	0	0.143
			Banana	eg	0.0675	1	0	0.124
				ho	0.0451	1	0	0.083
				ovg	0.1145	1	0	0.211
			Cassava		0.0977	1	0	0.180
		Cassava			0.0853	1	0	0.157

CROPPING PATTERNS (continued)

<----- main crop in mixture ----->				minor mixture code	mean plot area (ha)	number of plots	% plots	% area
crop code	<----- crop name ----->							
	first	second	third					
r	r	v	Cabbage		0.1308	1	0	0.241
			Vegetable		0.0536	1	0	0.099
			Banana	l	0.0332	1	0	0.061
			Taro	oj	0.0445	1	0	0.082
					0.0612	1	0	0.113
s	Taro				0.0354	25	12	1.635
		Coconut	Banana	eh	0.1370	1	0	0.253
		Grain crops	Cabbage	fl	0.0513	1	0	0.094
			Banana		0.0955	2	1	0.353
		Banana			0.1013	11	5	2.060
			Grain crops	t	0.1704	1	0	0.315
			Vegetable		0.1424	1	0	0.263
				g	0.0766	1	0	0.141
			Sugar cane		0.0324	1	0	0.059
				gt	0.1272	1	0	0.235
			Yam		0.2079	1	0	0.384
				h	0.0811	1	0	0.149
			Cassava	ge	0.0383	1	0	0.070
		Sweet potato	Grain crops	vh	0.1123	1	0	0.207
			Banana	gt	0.0324	1	0	0.059
				u	0.1397	1	0	0.258
		Yam	Cabbage	ojh	0.0502	1	0	0.092
			Pana	vjg	0.0361	1	0	0.066
		Cassava	Vegetable	l	0.0295	1	0	0.054
t	Yam				0.0192	3	1	0.106
		Pana			0.0119	3	1	0.066
			Banana	h	0.0261	1	0	0.048
u	Pana				0.0285	8	4	0.421
		Sweet potato	Banana	sg	0.0978	1	0	0.180
			Taro		0.0562	1	0	0.103
		Yam			0.0316	3	1	0.175
			Vegetable		0.1300	1	0	0.240
			Sweet potato		0.0257	1	0	0.047
			Taro		0.0400	1	0	0.073
				gl	0.0186	1	0	0.034

Crop Key:

a	Cleared land	j	Fruit crops	r	Sweet potato
b	Coconut	k	Fruit trees	s	Taro
c	Cocoa	l	Banana	t	Yam
d	Pasture	m	Citrus trees	u	Pana
e	Grain crops	n	Nut trees	v	Cassava
f	Beans	o	Sugar cane	w	Other root crop
g	Cabbage	p	Food/building tree		
h	Vegetable	q	Tobacco		
i	Spices				

Table: 9.4
TREE CROPS IN GARDENS

<----- average number of trees per garden ----->

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
i) In cultivated gardens:					
fruit trees		0.77		1.71	1.43
citrus					
nut trees		3.40		0.52	1.36
sweet banana		0.21		0.09	0.13
cooking banana		1.81		2.86	2.53
ii) In fallow of gardens:					
fruit trees		0.61		1.88	1.50
citrus					
nut trees		3.24		0.53	1.31
sweet banana		0.21		0.02	0.08
cooking banana		3.60		4.37	3.60

<----- number of observations ----->

crop type:	cleared land	tree crops	short term cash crops	food crops	many but "unknown"
i) In cultivated gardens:					
fruit trees		31		73	
citrus		31		73	
nut trees		30		73	1
sweet banana		28		66	10
cooking banana		27		59	18
ii) In fallow of gardens:					
fruit trees		31		72	1
citrus		31		73	
nut trees		29		72	3
sweet banana		28		65	11
cooking banana		27		57	20

9.14 Bananas, particularly for cooking, fruit trees and nut trees are the tree crops of importance.

Chapter: 10

COCONUT AND COCOA

10.1 Coconut and cocoa have been studied in some detail before, both in the 1974-75 Sample Survey of Agriculture⁽⁵⁾ and in the 1985 Coconut Survey⁽⁶⁾. Only comparative data are therefore included in the present survey.

10.2 Copra exports from Solomon Islands started in the late 19th century, rising from 1,220 MT in 1895 to 23,000 MT in the '20s and '30s. Following disruption during the second world war production did not achieve pre-war levels again until the 1960s. Copra production has continued to rise since, exceeding 40,000 MT in 1984 and 1985. Following cyclone Namu copra production fell by about 20 to 25%, but showed some recovery in 1987/88.

10.3 The structure of the copra economy has varied considerably since the start of trading. Initially a smallholder crop, the plantation sector came to dominate production from 1915 onwards. Since the 1970s smallholder production has been growing by about 4.5% annually and smallholder copra production now accounts for around 70% of the total⁽⁸⁾.

10.4 The area under smallholder coconuts has expanded considerably over the past 15 years, in part due to a subsidy scheme operating from 1968 to 1978 which was designed to encourage the rehabilitation, planting and replanting of coconut palms. Consequently the age structure of smallholder palms is young, with almost half the palms planted since 1970 and nearly 90% planted since the war⁽⁸⁾.

10.5 The total number of coconut palms in Solomon Islands is estimated to be around 9 million, covering an area of approximately 60,000 hectares. Table 10.1 shows the provincial breakdown of copra production, in which Western, Guadalcanal, Malaita and Central Provinces account for about 80% of production.

10.6 The mean national copra yield is 0.72 MT per hectare according to the 1985 Coconut Survey⁽⁷⁾. The 1974-75 Sample Survey of Agriculture found that the average number of coconuts per palm was 36 (30 in the 1985 Coconut Survey) and assumes an average whole nut weight of 1.2kgs with 190gm dried copra equivalent per nut. Disciplined plantings were found to yield 40% more per tree than customary plantings, but only 7% more per unit area because of the greater density of customary planted trees. This result was questioned in the 1985 Survey.

Table: 10.1

COPRA AREA AND PRODUCTION BY PROVINCE (1984)

Province	<-- area -->		<-- production -->		yield	number of palms
	(ha)	%	(MT)	%	(MT/ha)	
Western	14,454	25	13,816	32	0.96	2,093,795
Ysabel	5,230	9	2,969	7	0.57	817,555
Central	7,909	13	9,073	21	1.15	1,287,680
Guadalcanal	12,758	22	7,324	17	0.57	1,824,790
Malaita	11,890	20	5,575	13	0.47	1,980,595
Makira	3,555	6	2,662	6	0.75	540,810
Temotu	3,032	5	1,167	3	0.38	494,420
Total	58,918	100	42,586	100	0.72	9,039,645

Source: Statistics Office, Solomon Islands (1986), Statistical Bulletin 18/86

10.7 The yield from well maintained plantations was found to be higher than from poorly maintained plantations, but the 1985 Coconut Survey attributed this to more intensive harvesting rather than the productivity of palms⁽⁵⁾.

10.8 In the 1985 Coconut Survey soil type was classified into three broad categories. 41% of plots lay on sand or coral; 47% on black alluvial soils; and 21% on red clay. It was concluded that the reason for low yields is often area specific but soil nutrient deficiency, notably potassium, is an important factor. Despite this, and high copra prices at the time, the 1974-75 survey found that "fertilizer is only applied when provided under some sort of subsidy scheme" and that "smallholder farmers will not buy fertilizer to use on their own plots. There is generally a lack of understanding of the use of fertilizer by farmers, and in many cases a reluctance to use it even when it is provided at a subsidised price"⁽⁵⁾.

10.9 Other important factors identified in the 1985 Coconut Survey as affecting production were pests and disease. Over half the plots sampled in the 1985 suffered from Leaf Spot, which may refer to the symptoms of pest infestation or nutrient deficiency. One quarter of plots showed some evidence of White Thread, but it was felt that neither problem significantly affected output. About 40 to 50 percent of plots were felt to be disease free⁽⁷⁾.

10.10 Amblypelta cocophaga appeared to be a significant pest in parts of Western province, the Floridas, Guadalcanal and Malaita. 38% of households reported premature nutfall which is linked to Amblypelta in certain localities. Brontispa spp was also evident, and minor pests included rhinoceros beetle, (Scapanes australis), rats, cockatoos, flying foxes and others⁽⁷⁾.

10.11 The coconut survey of 1985 found that the average spacing of 7.5 metres for palms was not significantly different between triangular and square planted plots. On customary plantings there was a wide variation in planting density, but the majority of plots were similar to disciplined plantings⁽⁷⁾.

10.12 The 1974-75 sample survey of agriculture found that more than half of all immature palms were well maintained. Among bearing trees more than 60% of disciplined plantings were well maintained compared to 47% of customary planted palms⁽⁵⁾. The 1985 coconut survey found lower management standards, and that even with 30% of farmers hiring workers to assist with maintenance only 39% of plots were well brushed. 47% revealed weed growth to shoulder height, and 13% of plots were totally neglected⁽⁷⁾. The relationship between levels of maintenance, yield and soil conditions was not established in the 1985 survey.

10.13 Table 10.2 presents additional results from the present study. Of 32 plots recorded, 20 are coconut, 6 are cocoa and 6 are mixed coconut and cocoa.

10.14 Maintenance standards in the survey area are fairly high, with plots brushed at least to shoulder height, except in 55% of coconut stands which have a ground cover of secondary bush. Overall 28% of plots undercropped (ie new plantings in food gardens), 22% are brushed to ground level, 16% are brushed to shoulder height and 34% have a ground cover of secondary bush. Maintenance levels are illustrated in diagram 10.1.

Table: 10.2

COCONUTS AND COCOA

<----- % plots ----->
 coconut cocoa coconut
 + cocoa

i) Intercropping:

Pure stand	85	83	
Intercropping with:			
Coconut + cocoa			100
Short term cash crops			
Food crops	15	17	
Livestock			
Total %	100	100	100
Number of observations (plots)	20	6	6

ii) Maintenance:

Undercropped	20	33	50
Brushed to ground level	10	50	33
Brushed to shoulder height	15	17	17
Secondary bush	55		
Burnt			
Total %	100	100	100
Number of plots	20	6	6

iii) Coconut variety composition

Tall	95	100
Rennel	5	
Dwarf		
Other		
Total %	100	100
Number of plots	20	6

iv) Coconut age composition

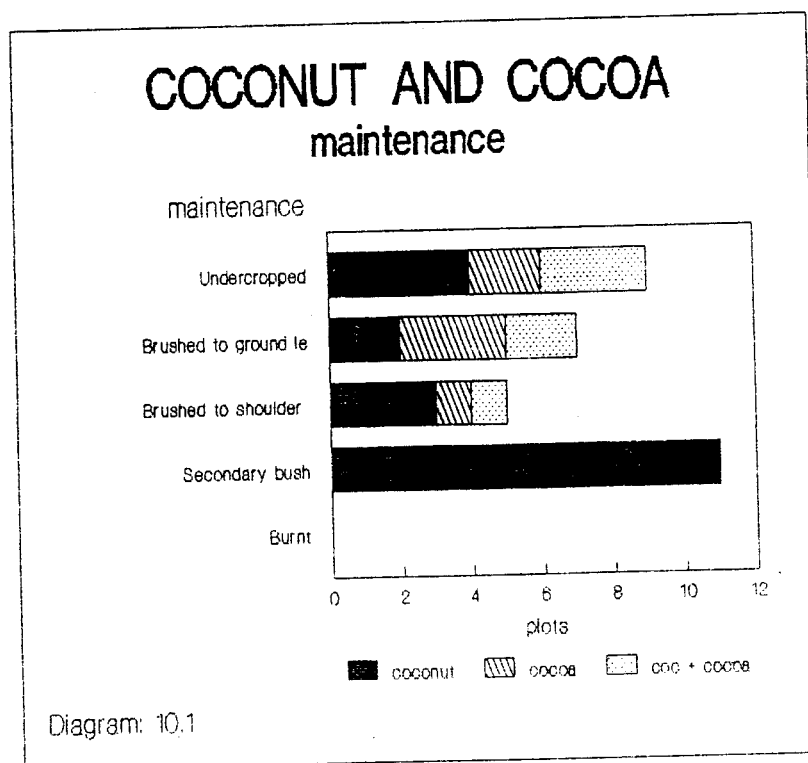
< 8 years	36	57
9 - 16 years	15	17
17 - 40 years	49	27
> 40 years senescent		
Total %	100	100
Number of plots	20	6

v) Cocoa age composition

< 3 years	52	100
3 - 5 years	32	
6 - 25 years	17	
> 25 years		
Total %	100	100
Number of plots	6	6

vi) Cocoa shade

coconuts		100
planted shade	17	
natural shade	83	
planted and natural		
Total %	100	100
Number of plots	6	6



10.15 In the survey the coconut variety is mainly local tall although there is one occurrence of Rennel palms. 41% are eight years or less in age, 15% are 9-16 years and 44% are 17-40 years.

10.16 76% of cocoa plantings are less than three years of age, 16% are 3 - 5 years and 8% are 6 - 25 years. 50% of cocoa is grown under coconuts, the rest under planted or, more commonly, natural shade.

Chapter: 11

FALLOW

11.1 Throughout Solomon Islands almost all gardens are cultivated according to a form of shifting cultivation with bush fallow. In the 1974-75 Sample Survey of Agriculture it was found that, where population density or land tenure problems have restricted the availability of suitable land, the length of fallow may be reduced from the optimum 7 to 20 years to as little as one or two years. In such areas soil fertility is diminished through over frequent cropping⁽⁵⁾.

11.2 Solomon Islands soils generally have a low to very low potassium status. The geology of the country is composed in the main of rocks which are low in potassium bearing minerals, and potassium is readily leached under conditions of continuously high rainfall and rugged topography. Fallow is essential for the restoration of potassium fertility: "Under traditional shifting cultivation the depletion of potassium by crops is gradually reversed over a period of 3-15 years or more by a combination of mineral weathering and root systems incorporating potash in the nutrient cycle". Although burning leads to an erratic distribution of potassium in the topsoil, "the burning of vegetative trash is beneficial and it has been shown that topsoil potassium is increased by as much as 100% on average after burning,⁽⁹⁾ all of this increase being held by the exchange complex".

11.3 Research on Malaita has shown that the average tuber yield of sweet potato is 9.3t/ha on sites of more than 10 years of fallow, falling off rapidly to 6.0t/ha on land of 5 - 9 years of fallow; 4.8t/ha on land of 0 - 4 years of fallow; and 3.5t/ha on successively cropped land. A residual yield of 2 - 6t/ha "seems to represent the rate of release of potassium from slowly available reserves in soil and weathering parent material within rooting depth". Large amounts of fertiliser are required to restore yields. A supply of 112kg/ha K is only marginally beneficial and inadequate to replenish the rate of potassium removal by the crop. 200 to 300kg/ha K is said to be required to restore⁽⁹⁾ yields to levels commensurate with long fallow periods.

11.4 Phosphorus varies widely in its total and available forms, but Solomon Islands soils generally have low levels in the subsoil and medium levels of total phosphorus in the topsoil. Most soils used for agriculture have satisfactory levels of phosphorus but as land pressure increases deficiencies may become more widespread. Humus in the topsoil is accompanied by an increase in phosphorus, mainly in organic form, which may become readily available⁽⁹⁾.

11.5 Soil total nitrogen levels are generally adequate, with C:N ratios in the range 7-13 signifying the ready availability of nitrogen. Topsoil nitrogen is dependent on land use and in particular the length of fallow since there is a build-up of topsoil nitrogen under secondary regrowth. Sulphur is similarly associated with organic matter, and is higher under forest than under burned grassland⁽⁹⁾.

11.6 There is a close relationship between pH and organic matter. The lower the pH the greater the surface organic matter and the higher the subsoil organic carbon content. Difficulties associated with low pH such as aluminium toxicity are only likely to be widespread in the New Georgia group and possibly Ysabel. Alkaline soils are fairly widespread and are associated with reef limestone. The chief problem induced by alkaline calcareous soils is lime induced chlorosis of foliage which results from deficiencies of iron, manganese, zinc and copper⁽⁹⁾.

11.7 In addition there is a close relationship between soil depth and soil fertility. "All stable sites tend to favour an accumulation of maximum weathered material due to minimal losses by surface erosion. Thus there arises the paradox that on stable hill sites and terraces the soils tend to be deepest but least fertile, while on adjacent steep slopes the soils are relatively unweathered, and hence fertile, but shallow"⁽⁹⁾.

11.8 The shifting system of smallholder agriculture in Solomon Islands is suited to the environment and prevailing management where land pressure is low. Soil fertility is restored during fallow periods, and small isolated areas of mixed cropping are not conducive to pest build-up. Burning of surface vegetative trash not only releases a flush of nutrients, of which the most important is potassium, but is also a useful phytosanitary measure which destroys weed seeds, some insects and undesirable pathogens⁽⁹⁾.

11.9 An analysis of fallow therefore tells much about the dynamics of smallholder agriculture, and likely pressures on farming systems. Hansell and Wall⁽¹⁰⁾ state that "there is little doubt that the major factor influencing the decision to abandon the garden is the decline in crop productivity but the exact causes of the decline are not fully understood". The greatest decline in production is between the first and second crops, rather than between the second and subsequent crops. They estimate that despite reduced yields there is still a good return from a low input of labour and conclude that reduced yields alone is insufficient reason for the abandonment of a garden. An important consideration may be the build-up of soil-borne plant diseases causing the rotting of corms or tubers, insect attack and weed infestation⁽¹⁰⁾.

11.10 In the 1974-75 Sample Survey of Agriculture⁽⁵⁾ it was stated that, while in overall terms Solomon Islands cannot be said to be suffering from land pressure, it may occur in some areas. Table 11.1 shows the distribution of garden land by the length of the bush fallow in 1975.

Table: 11.1
LENGTH OF BUSH FALLOW (1975)

length of bush fallow (years)	Western	Ysabel Central Guadalcanal	Malaita	Makira Temotu	Solomon Islands
	% observations				
< 2	23	6	17	16	14
2 - 4	20	5	33	14	18
5 - 7	4	11	25	12	15
8 - 10	10	10	8	15	10
> 10	13	20	3	14	13
never previously cultivated	29	48	15	29	32
Mean length fallow (years)	5.6	9.2	4.5	6.7	6.4

Source: Statistics Office (1978), 1974-75 Agricultural Statistics Survey

11.11 Table 11.2, also from the 1974-75 survey, shows the distribution of garden land by length of cultivation.

Table: 11.2
LENGTH OF CULTIVATION (1975)

length of cultivation (months)	Western	Ysabel Central Guadalcanal	Malaita	Makira Temotu	Solomon Islands
	% observations				
< 4	20	45	11	19	27
4 - 6	62	31	36	22	37
7 - 9	12	13	25	33	19
10 - 12	5	8	14	18	10
> 12	2	4	14	8	7
Mean cultivation (months)	5.1	4.7	7.6	7.2	6.0

Source: Statistics Office (1978), 1974-75 Agricultural Statistics Survey

11.12 In 1975 it was found that 32% of gardens in Solomon islands had never been previously cultivated, and that the average length of bush fallow of cultivated gardens was 6.4 years. Only 7% of gardens were generally cultivated for more than 12 months before reverting to fallow, and the average length of cultivation of food gardens was 6 months.

11.13 Table 11.3 summarises cropping intensity in the survey area. The crop period is shown in the first column, which is the time from planting to harvest for the named crop.

Table: 11.3
CROPPING INTENSITY

crop type		harvest to harvest (months)	number of crops in sequence	number of cases (obs)
all crops		6.4	2.2	201
cleared land	a	5.4	1.7	13
coconut	b	6.7	2.1	22
cocoa	c	6.3	2.5	8
grain crops	e	1.5	3.0	2
vegetable	h	2.7	2.7	3
fruit crops	j	5.5	3.0	2
sweet potato	r	4.1	2.3	73
taeo	s	9.4	2.1	54
yam	t	7.6	2.1	7
pana	u	7.6	2.2	17

11.14 The second column describes the number of times an area is cropped in sequence before reverting to fallow. This introduces complexity since the crop type may, and commonly does, change within the sequence. The table therefore shows different stages in the cropping sequence. The dominant root crops are sweet potato and taro with 127 observations and pana with 17 observations.

11.15 Table 11.4 describes the fallow period, however, this has little meaning for tree crops since the interpretation of fallow varies with the age of the tree crop and previous cropping history. For food crops the fallow period relies on the knowledge of the respondent. Often it is found that long fallow periods are beyond the memory of operators and these are referred to as "cases longer than memory". 95% of gardens have such long fallows. Where the fallow period is known on food gardens there are 6.0 years of fallow between cropping.

Table: 11.4
FALLOW PERIOD (years)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
mean years of fallow				6.0	6.0
standard deviation (years)				2.5	2.5
number of cases (gardens)				5	5
cases longer than memory					99
total cases (gardens)					104

11.16 Fallow periods cover a range of soil and site conditions, and are themselves variable. Table 11.5 shows that 93% of fallow periods on food gardens are longer than memory, extending essentially over the entire food garden area.

Table: 11.5
FALLOW RANGE

i) Fallow Range by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no fallow					
1 year					
2 years					
3 years				1	1
4 years				1	1
5 years					
6 - 10 years				3	3
11 - 20 years					
21 - 50 years					
beyond memory ("long time")		31		68	99
total by crop type		31		73	104

ii) Fallow Range by % cultivated area

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no fallow					
1 year					
2 years					
3 years					
4 years					
5 years					
6 - 10 years					
11 - 20 years					
21 - 50 years					
beyond memory ("long time")		81		19	100
total by crop type		81		19	100

Note: The table of % area is only approximate due to rounding small numbers

11.17 The type of fallow in the survey area is shown in table 11.6.

Table: 11.6

FALLOW TYPE

i) Fallow type by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
primary forest		7		26	33
secondary forest		22		42	64
dense thicket				2	2
open scrub grassland		1		3	4
grassland					
plantation trees/planted		1			1
other fallow					
total by crop type		31		73	104

ii) Fallow type by % cultivated area

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
primary forest		7		9	17
secondary forest		70		9	80
dense thicket					
open scrub grassland		4			4
grassland					
plantation trees/planted					
other fallow					
total by crop type		81		19	100

Note: The table of % area is only approximate due to rounding small numbers

11.18 93% of all gardens have a fallow of primary or secondary forest extending over 97% of the cultivated area.

11.19 50% of the food garden area is cut from primary forest compared with 9% of the tree area. Since tree areas are semi-permanent while annual cropping is constantly shifting, the encroachment of food gardens on the primary forest may be relatively rapid with respect to the area under annual crops.

11.20 Table 11.7 summarises the application of agricultural inputs for the control of pests and maintenance of soil fertility. In the survey area only one case of fertiliser applied to cocoa was encountered.

Table: 11.7

MANAGEMENT AND APPLICATION OF AGRICULTURAL INPUTS

i) Inputs by frequency of use (gardens)

crop type		row planting	fert- iliser	pest- icide	compost	ash	other	frequency of plots
all plots		36	1					207
cleared land	a							13
coconut	b	23						25
cocoa	c	11	1					11
cabbage	e							2
fruit crops	h							3
sweet potato	j	2						2
taro	r							73
yam	s							54
pana	t							7
cassava	u							17

ii) Inputs by % area applied

crop type		row planting	fert- iliser	pest- icide	compost	ash	other
all plots		81	4				
cleared land	a						
coconut	b	69					
cocoa	c	13	4				
cabbage	e						
fruit crops	h						
sweet potato	j						
taro	r						
yam	s						
pana	t						
cassava	u						

Note: The table of % area is only approximate due to rounding small numbers

Chapter: 12

LANDFORM

12.1 The survey area is on the north west peninsula of Makira between Rumahui and Tawainia'u, an area of fairly extensive lowlands and moderate relief.

12.2 Landforms are broadly subdivided into "lowland" and "upland" where "upland" simply means above the coastal plain or coastal terrace, but does not imply high elevation. Table 12.1 shows the distribution of cultivated land in the survey by landform. The first part of the table records the number of observations (gardens) which is expressed in area terms in the second part of the table.

12.3 65% of tree gardens representing 78% of the tree garden area are on lowland sites, with the remainder on sloping upland sites. 49% of food crop gardens representing 50% of the food garden area are on lowland sites, the remainder on mainly steeply sloping sites.

Table: 12.1

LANDFORM

i) Landform by number of observations (gardens)

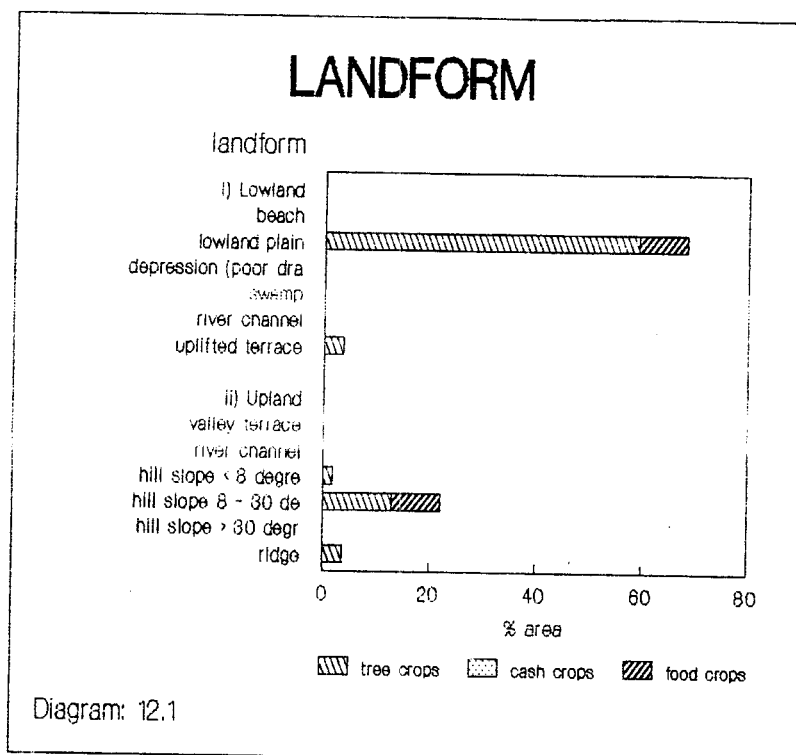
crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
i) Lowland					
beach					
lowland plain		20		36	56
depression (poor drainage)					
swamp					
river channel		1			1
uplifted terrace		1			1
ii) Upland					
valley terrace					
river channel					
hill slope < 8 degrees		1		5	6
hill slope 8 - 30 degrees		7		32	39
hill slope > 30 degrees					
ridge		1			1
total by crop type		31		73	104

ii) Landform by % cultivated area

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
i) Lowland					
beach					
lowland plain		59		9	69
depression (poor drainage)					
swamp					
river channel					
uplifted terrace		4			4
ii) Upland					
valley terrace					
river channel					
hill slope < 8 degrees		2			2
hill slope 8 - 30 degrees		13		9	22
hill slope > 30 degrees					
ridge		4			4
total by crop type		81		19	100

Note: The table of % area is only approximate due to rounding small numbers

12.4 A summary of landform and cropping is illustrated in diagram 12.1.



12.5 Table 12.2 describes the characteristics of slope in farming systems. The first part of the table records the frequency of observations (plots) which is expressed in area terms in the second part of the table.

12.6 The mean slope is 5 degrees. 135 plots or 65% of all plots, representing 80% of the total cultivated area, are on sites of less than 5 degrees slope. 13% of the cultivated area is on slopes of 5 to 10 degrees while 8% is on slopes of between 10 and 30 degrees.

Table: 12.2
SLOPE

i) Slope by number of observations (gardens)

crop type	mean slope (degrees)	frequency of plots at different degrees of slope						frequency of plots
		0 - 5 degrees	5 - 10 degrees	10 - 20 degrees	20 - 30 degrees	30 - 50 degrees	> 50 degrees	
all plots	5	135	34	32	6			207
cleared land	a	5	7	3	3			13
coconut	b	3	19	4	1	1		25
cocoa	c	1	10	1				11
cabbage	e		2					2
fruit crops	h		3					3
sweet potato	j		2					2
taro	r	5	45	13	11	4		73
yam	s	6	31	12	10	1		54
pana	t	7	4		3			7
cassava	u	5	12	1	4			17

ii) Slope by % cropped area

crop type		frequency of plots at different degrees of slope						total
		0 - 5 degrees	5 - 10 degrees	10 - 20 degrees	20 - 30 degrees	30 - 50 degrees	> 50 degrees	
all plots		80	13	6	2			100
cleared land	a							
coconut	b	57	9	4	2			72
cocoa	c	13						13
cabbage	e							
fruit crops	h							
sweet potato	j							
taro	r	6	2	2				9
yam	s	4	2					6
pana	t							
cassava	u							

Note: The table of % area is only approximate due to rounding small numbers

12.7 Table 12.3 summarises conservation measures. No conservation practices or alley cropping were encountered in the survey.

Table: 12.3
CONSERVATION AND ALLEY CROPPING

i) Conservation by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
i) Conservation none contour cultivation bunding terracing		31		73	104
ii) Alley cropping not performed performed		31		73	104
total by crop type		31		73	104

ii) Conservation by % cultivated area

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
i) Conservation none contour cultivation bunding terracing		81		19	100
ii) Alley cropping not performed performed		81		19	100
total by crop type		81		19	100

Note: The table of % area is only approximate due to rounding small numbers

12.8 The spatial distribution of gardens is shown in diagrams 12.2 to 12.4, which illustrate the relationships between crop type, crop area, and the distance of gardens from households.

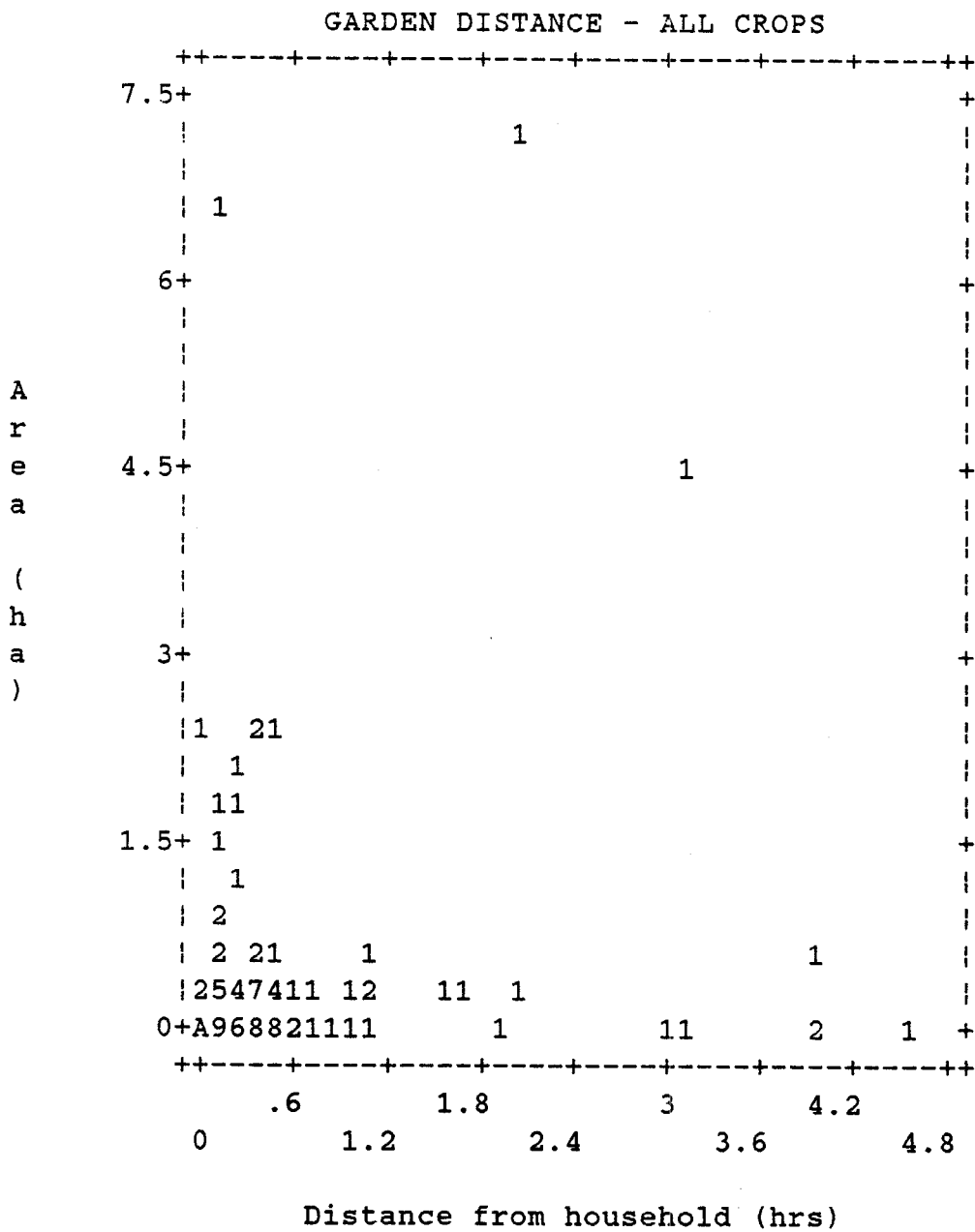
2.9 Diagram 12.2 is the graph of gardens for all crops, while subsequent diagrams show the distance relationships for the major crop types. The graph shows the relationship between garden area (vertical axis) and the time taken to reach the garden from the household (horizontal axis). Graph entries represent the number of observations (gardens) and are numbered from 1 to 9 and thereafter alphabetically. Thus where points coincide the number of points is shown: 9 occurrences is recorded as "9"; 10 occurrences as "A"; 13 occurrences as "D"; and so on.

12.10 The mean time taken to reach gardens is .519 hours, or about 31 minutes, with a maximum time of 4.30 hours. There is no clear relationship between garden size and distance from the household.

12.11 Diagram 12.3 shows the relationship between distance and area of tree crop gardens. The mean time taken to reach tree crop gardens from the household is .651 hours, with a maximum recorded time of 4.00hrs.

12.13 The mean time taken to reach food gardens from the household is .463 hours, with a maximum time of 4.30 hours.

Diagram: 12.2

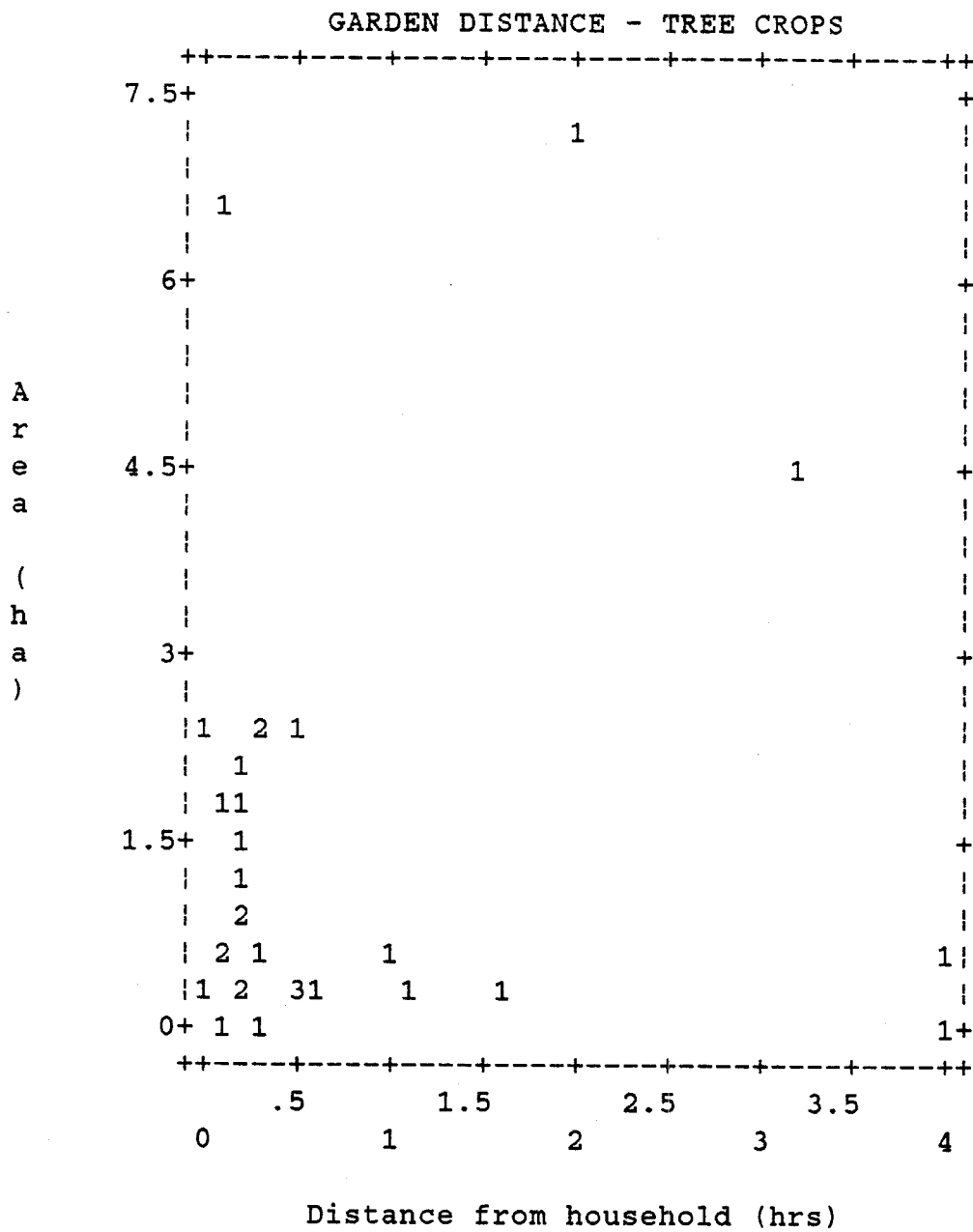


Mean = .519 hrs

Max = 4.30 hrs

Number of observations (gardens) = 104

Diagram: 12.3

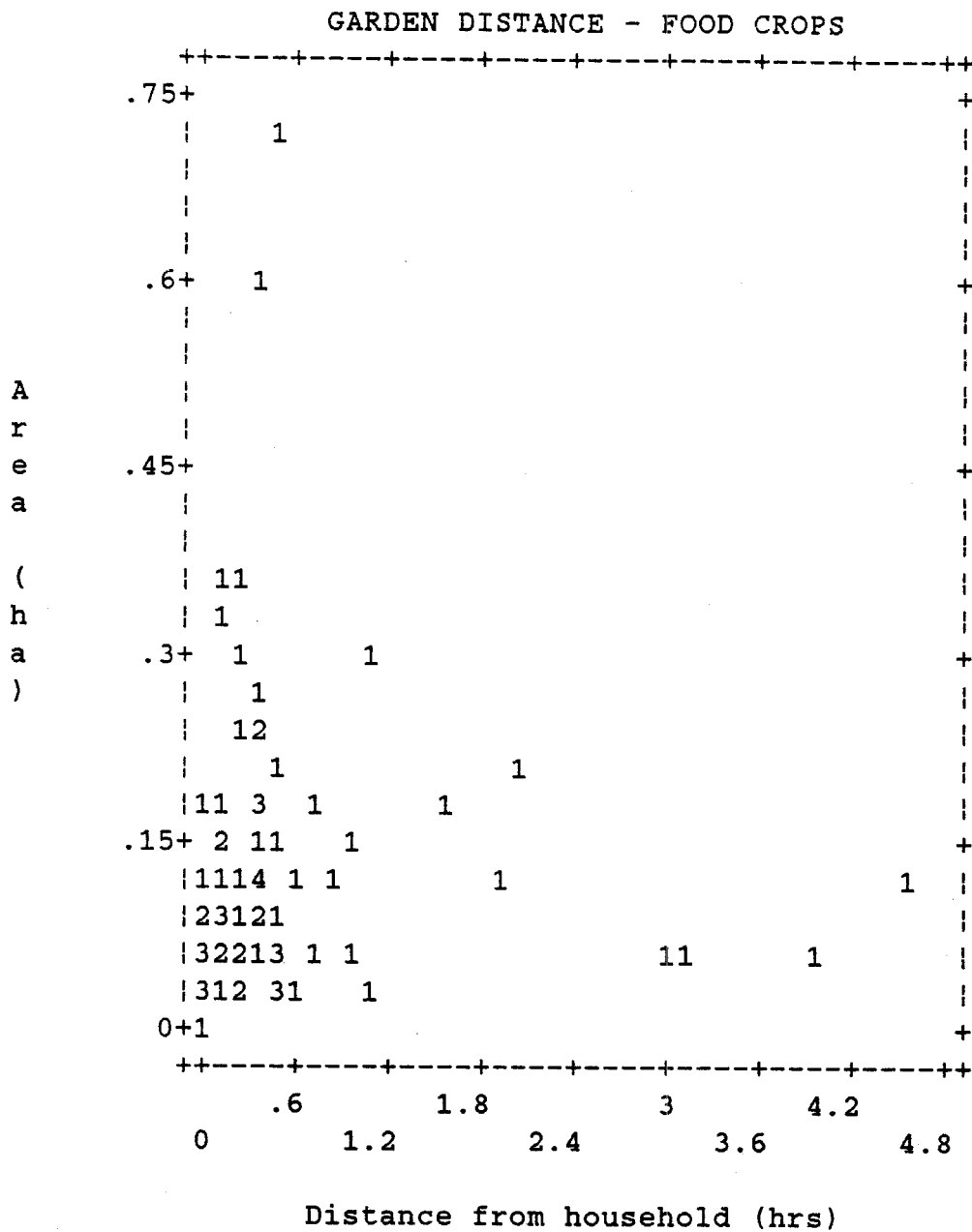


Mean = .651 hrs

Max = 4.00 hrs

Number of observations (gardens) = 31

Diagram: 12.4



Mean = .463 hrs

Max = 4.30 hrs

Number of observations (gardens) = 73

Chapter: 13

ADVERSE FACTORS AFFECTING PRODUCTION

13.1 Table 13.1 describes site factors which farmers regard as problems. The first part of the table specifies the number of observations (gardens), which is expressed as the proportion of cultivated area affected in the second part of the table.

Table: 13.1
SITE CONDITIONS

i) Site Conditions by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no site limitation		23		63	86
poor soil/site		4		1	5
pest/disease problem				9	9
poor site + pests					
weed problem		4			4
weeds + poor site					
weeds + pests					
weeds + site + pests					
total by crop type		31		73	104

ii) Site Conditions by % cultivated area

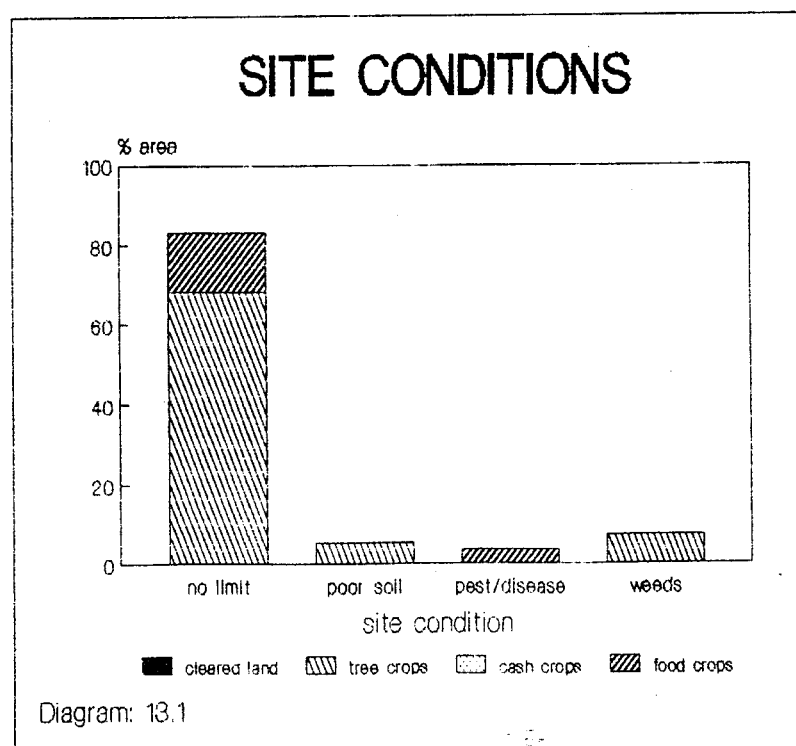
crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no site limitation		69		15	83
poor soil/site		6			6
pest/disease problem				4	4
poor site + pests					
weed problem		7			7
weeds + poor site					
weeds + pests					
weeds + site + pests					
total by crop type		81		19	100

Note: The table of % area is only approximate due to rounding small numbers

13.2 83% of all gardens (86 gardens) representing 83% of the cultivated area have no apparent site limitations. Site problems may be summarised by grouping the main factors as follows:

	<u>% gardens</u>	<u>% area</u>
No site limitations	86	83
Poor soil/site	5	6
Pests/disease	9	4
Weeds	4	7

Site conditions are illustrated in diagram 13.1.



13.3 The major problems of poor soils, pests and disease, and weeds are encountered only over small areas.

13.4 Table 13.2 describes major physical crop damage where again there is little damage encountered except on food gardens. Damage, mainly from birds and rats to tree crops affects 10% of tree crop gardens and 5% of the tree crop area. 5% of the tree crop area is also affected by cyclone damage. 55% of food crop gardens extending over 58% of the food garden area are damaged, mainly by rats.

Table: 13.2

CROP DAMAGE

i) Crop Damage by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no damage		28		33	61
cyclone damage					
other damage		2		40	42
cyclone and other damage		1			1
total by crop type		31		73	104

ii) Crop Damage by % cultivated area

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no damage		74		7	81
cyclone damage					
other damage		4		11	15
cyclone and other damage		4			4
total by crop type		81		19	100

Note: The table of % area is only approximate due to rounding small numbers

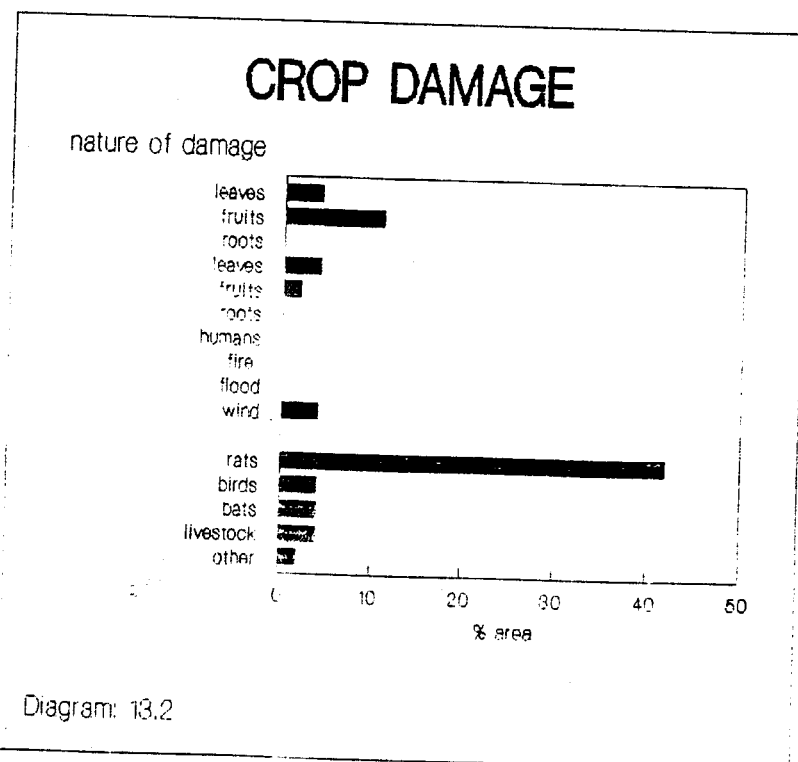
"Other" damage on tree crops is birds and rats

food crops is mainly rats

13.6 Annex 3 provides a more detailed description of factors damaging crop mixtures, summarised at the plot level. It is not possible at this stage to present results at the crop level. Results are summarised in table 13.3 and are illustrated in diagram 13.2.

Table: 13.3
SUMMARY OF CROP DAMAGE

nature of damage		% cropped area affected
insects affecting	leaves	4
	fruits	11
	roots	
disease affecting	leaves	4
	fruits	2
	roots	
damage due to	humans	
	fire	
	flood	
	wind	4
	rats	42
	birds	4
	bats	4
	livestock	4
	other	2



Chapter: 14

CROP YIELDS

14.1 Production data on smallholder agriculture are scarce, largely due to practical difficulties associated with measuring yields in complex cropping systems that lack clear temporal and spatial boundaries. Smallholder agriculture is a continuous process in which there is little seasonality, so that any or all stages of crop growth and management operations may be exhibited at any time, with crops commonly harvested selectively over time. Table 14.1 summarises the planting characteristics of smallholder crops in the survey area.

Table: 14.1
CROP VARIETY AND SPACING

(<----- crop type ----->)		number of observations	% improved	(<----- spacing (% obs) ----->)		
				customary	regular	recommended
						<---- tree crops ---->
						triangular square
Cleared	Cleared land	7				
Coconut/Cocoa	Coconuts	31	3	55	13	32
	Cocoa	17		35		65
Ground crops	Grain crops	21		100		
	Beans	8		100		
	Cabbage	23		100		
	Vegetable	17		94	6	
	Chilli					
	Fruit Crops	11		91		9
Tree/other crops	Fruit trees					
	Banana	45		100		
	Citrus trees					
	Nut trees					
	Sugar cane	7		100		
	Food/building tree					
	Tobacco	2		100		
Root crops	Sweet potato	82		100		
	Taro Common	28		100		
	Giant					
	Hong Kong	44		100		
	Swamp					
	Yam	22		100		
	Pana	23		100		
	Cassava	15		100		
	Other root crop					
Total		403				

14.2 The second column refers to the introduction of non-traditional planting material, either through extension or research, or from other sources.

14.3 For non-tree crops there are three types of spacing identified, being "customary", "regular" and "recommended". "Customary" means there is no discernable order in the plot. "Regular" means planting according to a visible pattern, such as in rows. "Recommended" refers to the adoption of recommended practices, which may not necessarily be "regular". For tree crops there are four categories of "customary", "regular", "triangular" and "square". "Customary" and "regular" follow the same rules as non-tree crops. "Triangular" and "square" equate with recommended practices for coconuts.

14.4 Crop mixtures in smallholder farming systems are complex, as seen in table 9.3. Table 14.2 describes something of the complexity of planting densities. While 71% of coconut plots are pure stand, complexity is exhibited in the planting of most crops. In general around one third of root crops are pure stand, but for the most part crops are grown in complex mixtures.

Table: 14.2
CROP DOMINANCE IN MIXTURES

[illegible]

14.5 A visual assessment of yields is presented in table 14.3.

Table: 14.3
CROP PRODUCTION

<----- crop type ----->		number of observations	<----- yield appearance (% obs) ----->			
			zero	low	moderate	high
Cleared	Cleared land					
Coconut/Cocoa	Coconuts	31		13	84	3
	Cocoa	17		6	94	
Ground crops	Grain crops	21		14	86	
	Beans	8			100	
	Cabbage	23		26	74	
	Vegetable	17		6	88	6
	Chillie					
	Fruit Crops	11	9	18	73	
Tree/other crops	Fruit trees					
	Banana	45			96	4
	Citrus trees					
	Nut trees					
	Sugar cane	7			100	
	Food/building tree					
	Tobacco	2			100	
Root crops	Sweet potato	82		16	84	
	Taro Common	28			96	4
	Giant					
	Hong Kong	44		14	82	5
	Swamp					
	Yam	22			100	
	Pana	23			96	4
	Cassava	15			100	
	Other root crop					
Total		386				

14.6 Most crop yields are moderate while coconut yields are low to moderate.

14.7 In an intensive case study of this kind it is difficult to obtain a reasonable coverage of crop yields, although these are recorded where possible in the course of the survey⁽¹²⁾. A crop production study has been designed to generate yield data⁽²²⁾ but it has not been possible to implement this yet. For the present report yields are largely derived from secondary sources.

a) **COCONUT:**

14.8 Coconut production data from the 1974-75 agricultural survey are summarised in table 14.4.

Table: 14.4

COCONUT PRODUCTION DATA FROM 1974-75 AGRICULTURAL SURVEY

	Province				Mean
	Western	Ysabel Central Guadalcanal	Malaita	Makira Temotu	
number of yield sites	28	32	3	30	93
coconuts per palm: disciplined	53	54	19	34	44
customary	22	36	1	41	31
mean	31	42	14	37	36
coconuts per ha : disciplined	8,194	8,983	2,822	5,773	7,178
customary	4,658	8,595	135	7,432	6,703
mean	5,794	8,753	1,926	6,492	6,913
% damaged/unusable nuts: disciplined	12	10	12	20	14
customary	19	13	36	6	13
mean	16	12	12	13	14
gross copra yield (kg/ha): disciplined	1,541	1,689	531	1,086	1,450
customary	876	1,616	25	1,398	1,261
mean	1,081	1,646	362	1,221	1,300
net yield (kg/ha): disciplined	1,356	1,520	467	869	1,247
customary	709	1,406	16	1,314	1,097
mean	908	1,448	318	1,062	1,118

Source: Statistics Office (1978) "1974-75 Agricultural Statistics Survey".

Note: Copra yields assume 190gm dried copra per nut quoted in the Statistics Office report

14.9 In the 1974-75 agricultural survey the mean coconut yield is estimated to be 1,300kg/ha copra equivalent, or 1,118kg/ha when unusable nuts are discounted. The average daily consumption of coconuts was found to be 4.2 per household, resulting in a national annual consumption equivalent of 8,871MT copra. If green nuts are taken into account it was believed that the copra equivalent consumed would be 10,000MT⁽⁵⁾ in a year when exports amounted to 28,000MT.

14.10 Charles (1980) estimates lower levels of copra production with estate yields of 827kg/ha and smallholder yields of 410kg/ha. The difference he attributed to a high proportion of immature plantings⁽²³⁾ and the consumption of coconuts in the smallholder sector. Average copra production derived from the 1985 coconut survey is estimated in the (draft) Farm Management Handbook for Solomon Islands to be 0.72MT/ha⁽²⁴⁾, although provincial yields vary from 1.15MT/ha in Central Province, which is dominated by the Levers plantation in the Russel Islands, to 0.38MT/ha in Temotu.

14.11 In conjunction with the 1985 coconut survey the Research Department of the Ministry of Agriculture and Lands has analysed the nutrient status of coconut soils in Solomon Islands⁽¹³⁾:

Coconut Soils Data:
(means of soils analyses conducted on Coconut Survey soils)

pH	N%	available P ppm	exchangeable K meq/100g	available K meq/100g
6.4	0.55	70	0.24	0.60

14.12 It was concluded that coconut soils are generally high in nitrogen, medium in phosphate, and low in potassium. Recent variety experimental results on fertilised coconuts show the following yields:

Coconut Research Results (dry copra eq kg/ha):

Site	Tenaru (Guadalcanal)	Gizo (Western)
Year	1985 : 1984	1985 : 1984
Dwarf:Rennel Hybrid	378 : 2,664	1,990 : 1,599
Dwarf:Local Tall Hybrid	383 : 1,391	:
Local Tall	:	1,830 : 334
Rennel	190 : 1,391	1,910 : 1,052
Mean	:	: 995

14.13 Four smallholder yields were obtained in the present survey resulting in a mean yield of 969kg/ha. Smallholder yields in the present report are estimated to be 800kg/ha dry copra equivalent usable nuts.

b) COCOA:

14.14 Research trials on cocoa⁽¹³⁾ from 1977 to 1985 at Black Post in Guadalcanal produced a mean dry beans yield of 1,898kg/ha for Amelonado, 2,780kg/ha for AmlxNa33 hybrid, and 2,444kg/ha for AmlxPa7 hybrid.

14.15 Cocoa yields from various sources are quoted in the (draft) Farm Management Handbook for Solomon Islands⁽²⁴⁾:

Smallholder Cocoa Yields (kg/ha)⁽²⁴⁾:

Age of tree (year)	3	4	5	6	7	8
Friend (1970)	21	126	215	220	220	173
DBSI (1983) *	150	250	600	1,200	1,450	1,450
Hiele (1988)	208	450	560	685	719	719

* unverified source

14.16 High variability in yields was attributed to differences in management, such as in the application of fertiliser, weeding, and pest and disease control.

14.17 Two cocoa yields were obtained in the present survey, of 89kg/ha and 1,032kg/ha, a mean yield of 561kg/ha green beans. Smallholder cocoa yields are estimated in the present report to be 600kg/ha dry beans.

c) SWEET POTATO:

14.18 In a study of north-west Malaita, Frazer⁽¹⁵⁾ investigated the effect of fallow period on smallholder sweet potato yields. After a long fallow of 15-20 years the mean yield was found to be 14.84MT/ha from 8 observations. After a "short" fallow of less than 10 years the mean yield was 8.99MT/ha from 5 observations. Gollifer⁽¹⁶⁾ looked at the effects of potassium and nitrogen application on annual crops on soils of the Dala Series in Malaita, soils formed on a parent material of raised coral reef and characteristically low in potassium. He found unfertilised sweet potato yields of 5.5MT/ha (control for K) and 7.4MT/ha (control for N). The effect of potassium application was to increase yields by up to 86%, but nitrogen tended to stimulate vine growth at the expense of the tuber.

14.19 In a series of trials at Dala, Gollifer⁽¹⁷⁾ found unfertilised sweet potato yields to range widely, from around 0.25MT/ha to 24MT/ha. Yields in general were the order of 5MT/ha, which was estimated to be around half the typical North West Guadalcanal yield of 9.97MT/ha. Yield variability could not be attributed to variety or soil type, but a trend related to intensity of cropping did appear:

Effect of Recent Land History on Sweet Potato Yields (MT/ha):

land history	yield (MT/ha)
continuous cropping	3.51
0 - 4 years fallow	4.77
5 - 9 years fallow	6.03
more than 10 years fallow	9.29

Source: Gollifer (1969)

14.20 It was concluded that sweet potato and other root crops are demanding of, and remove large quantities of, potassium from the soil. A fallow-burn cycle is therefore essential to replenish soil fertility by making potassium available to shallow-rooted crops. It was considered that deep rooting trees may act as nutrient pumps, but the only practical way of shortening fallow periods was⁽¹⁷⁾ considered to be the application of potassium fertiliser.

14.21 Bathgate⁽¹⁸⁾ found also that yields vary according to soil fertility and growing time, as well as species and density of planting. In West Guadalcanal he quotes sweet potato yields of 7.16MT/ha after 20 years of fallow and 9.36MT/ha after 8 years of fallow, but based on a single sub-plot observation only in each case.

14.22 On the weather coast of Guadalcanal Chapman and Pirie⁽¹⁹⁾ studied the relationship between yields and cropping, and found yields to be high in comparison to studies elsewhere:

Sweet Potato Yield (MT/ha) - Weather Coast, Guadalcanal

successive crops	Ghauvalisi	Sughu	Hatare/Poinaho
1	41.67	18.08	17.82
2	15.31	10.54	9.79
3		10.29	9.79

Source: Chapman and Pirie (1974)

14.23 In the 1974-75 Agricultural Survey⁽⁵⁾ the mean yield of sweet potato was 15.7MT/ha, but this was felt to be an over-estimate.

14.24 More recent research provide further information on sweet potato yields, but results exhibit considerable variability across seasons and due to other causes:

trial	yield MT/ha		notes
	gross	marketable	
improved cultivars	17.9	14.5	25 obs
control	11.2	6.7	1 obs
dry season corn intercropping	15.9	7.1	135 days to harvest
	18.5	12.0	165 days to harvest
wet season corn intercropping	5.9	1.5	135 days to harvest
	11.0	3.4	165 days to harvest
dry season weevil control	15.3		no effect from insecticide
wet season weevil control	8.19	6.37	

Source: Research Department Annual Report 1984⁽¹⁴⁾ and 1985⁽¹³⁾

14.25 Eight yield observations were made on sweet potato during the present survey with a mean yield of 5,934kg/ha.

14.26 Smallholder sweet potato yields of usable crop are estimated in the present report to be 8MT/ha under long fallow of 8 years or more - falling to 5MT/ha for fallow of 4 to 8 years, and 3.5MT/ha for short fallow cropping.

d) TARO:

14.27 Taro yields in the literature are highly variable. Frazer⁽¹⁵⁾ found Colocasia esculenta to yield 8.94MT/ha in North Malaita, based on 10 observations. Gollifer⁽¹⁶⁾ on the Dala Series in Malaita found yields of 4.0MT/ha for unfertilised taro, which increased to 6.0MT/ha with 168kg/ha potassium fertiliser applied. Gollifer⁽¹⁷⁾ also quotes widely ranging unfertilised taro yields of 1.00 to 10.80MT/ha on experimental plots. In a spacing trial in Guadalcanal at Tenaru on which fertiliser was applied, the net undamaged taro yield for densities of 2,000 to

f) PANA:

14.31 Frazer⁽¹⁵⁾ quotes a for North Malaita, where on one observation only of Dioscorea esculenta produced a yield of 11.52MT/ha⁽¹⁴⁾. Fertilised cultivar trials at Dodo Creek Research Station in 1984 yielded 16.2MT/ha marketable tubers out of a total yield of 27.7MT/ha. 1983 results were higher, with 43.7MT/ha marketable tubers out of a total yield of 52.9MT/ha. The difference was believed to be due to inadequate fertiliser in 1984. In 1985 the mean fertilised yield of 8 cultivars was 24.3MT/ha marketable tubers⁽¹³⁾.

14.32 Smallholder pana yields in the present report are expected to be similar to yam yields - of 10MT/ha under long fallow, 6MT/ha under 4-8 years fallow, and 4MT/ha under short fallow.

g) CASSAVA:

14.33 Fertilised cassava in a time of harvest trial at Dodo Creek in Guadalcanal⁽¹³⁾ yielded 23.8MT/ha after 9 months and 27.8MT/ha after 12 months. In a fertilised germplasm collection trial on the Fataolo land system on Malaita⁽¹⁷⁾ cultivars ranged from 7.5 to 65.8MT/ha, with 50% above 40MT/ha⁽²⁸⁾.

14.34 Smallholder cassava is generally planted on less fertile sites and is commonly a minor crop in a mixture. It is high yielding, although of low nutritional value. Smallholder yields in the present report are estimated to be 10MT/ha.

h) MAIZE:

14.35 Gollifer⁽¹⁶⁾ quotes unfertilised maize yields of 1.90MT/ha on Dala soils in Malaita, but yields of 5.58MT/ha when fertilised with NPK. Further unfertilised maize yield data from Dala⁽¹⁷⁾ range from 1.55MT/ha to 2.13MT/ha.

14.36 Smallholder maize yields in the present report are estimated to be 1.8MT/ha.

4,000 plants/ha was around 5MT/ha, with 30% loss due to corm damage⁽¹⁴⁾. On the same site a high intensity inputs and management trial to investigate leaf blight yielded around 9MT/ha marketable corms⁽¹⁴⁾. The control yield in a 1985 taro beetle trial at Tenaru was 3.49MT/ha⁽¹³⁾. Tioti (1967) estimated taro yields to be 12.6MT/ha⁽²⁵⁾, but Gollifer (1970) quotes yields of 4.7MT/ha⁽²⁶⁾.

14.28 Two common taro yields were obtained in the present survey with a mean yield of 4,298kg/ha and two Hong Kong taro yields were obtained with a mean yield of 8,057kg/ha. Smallholder taro yield in the present report is estimated to be 5MT/ha.

e) YAM:

14.29 In North Malaita Frazer⁽¹⁵⁾ found yam yields of 5.16MT/ha for Dioscorea alata. Gollifer⁽¹⁷⁾ quotes unfertilised yam yields of 6.03MT/ha to 30.38MT/ha at Dala experimental station on Malaita. In 1984 an experiment to compare the yields of 18 yam cultivars was conducted at Tenaru in Guadalcanal⁽¹⁴⁾ in which the cultivars with high resistance to dieback yielded around 14 to 18MT/ha, with the highest resistance cultivar yielding 24MT/ha. Susceptible⁽²⁷⁾ cultivars produced yields as low as 2MT/ha. Maeinia⁽²⁷⁾ quotes very high yields of 50 - 63MT/ha for Malaita.

14.30 Smallholder yam yields are likely to be higher than those of sweet potato given that they tend to be planted on newly opened sites and the yield appearance is generally good. One yam yield of only 3,889kg/ha was obtained in the present survey. In general long term fallow is expected to yield 10MT/ha, fallow of 4-8 years to yield 6MT/ha and short fallow systems to yield 4MT/ha.

i) GROUNDNUT:

14.37 Golliifer quotes unfertilised groundnut yields in the range 527kg/ha to 1,278kg/ha from Dala in Malaita.

14.38 Smallholder groundnut yields in the present report are estimated to be 600kg/ha.

k) SUMMARY OF YIELDS:

14.39 Crop yields derived from the survey and secondary sources are necessarily imprecise because of the complexity of smallholder farming systems. Diverse crop mixtures, with varying crop densities and differing site conditions do not lend themselves to a simple analysis of crop yields or smallholder production. Crop yields in the literature are generally for pure stand crops, or very simple mixtures - under controlled or even modified conditions. There is then a need to study smallholder production under more realistic conditions, as is part of the on-going programme of the Agricultural Economics Section. In the meantime, a "best estimate" of typical smallholder yields in the project area is presented in table 14.5.

Table: 14.5
SMALLHOLDER CROP YIELDS

crop	condition	yield kg/ha
coconut	copra equivalent	800
cocoa	dry beans	600
sweet potato	> 3 years fallow	8,000
	4 - 8 years fallow	5,000
	< 4 years fallow	3,500
taro		5,000
yam	> 3 years fallow	10,000
	4 - 8 years fallow	6,000
	< 4 years fallow	4,500
pana	> 3 years fallow	10,000
	4 - 8 years fallow	6,000
	< 4 years fallow	4,500
cassava		10,000
maize		1,800
groundnuts		600

Chapter: 15

SMALLHOLDER PRODUCTION

15.1 Under the Rural Services "Project Beneficiary Monitoring and Evaluation" undertaken by the Statistics Office, gross crop offtake and other primary production were measured. Unpublished provisional results, courtesy of the Statistics Office, are presented in table 15.1.

Table: 15.1
DAILY SMALLHOLDER PRODUCTION

Average daily production from entire household (kg):

commodity	Province and Site						
	Ysabel	Central	Guadalcanal	Malaita	Makira	Temotu	Average
	Susubona	Hakama	Marau Sound	Afio	NW Peninsula	Lata	
sweet potato	8.00 :	2.67 :	6.68 :	3.79 :	4.09 :	4.19 :	4.90
cassava	1.26 :	0.98 :	2.15 :	0.35 :	0.63 :	0.04 :	0.90
yam	0.68 :	1.68 :	0.71 :	2.25 :	0.65 :	0.90 :	1.14
pana	0.58 :	4.60 :	0.32 :	0.06 :	0.34 :	0.12 :	1.00
taro	0.71 :	0.32 :	0.45 :	1.60 :	1.37 :	1.15 :	0.93
breadfruit	0.01 :	:	0.03 :	0.01 :	:	0.11 :	0.03
banana	0.55 :	0.56 :	1.85 :	0.83 :	2.06 :	0.28 :	1.02
sub-total	11.79 :	10.80 :	12.20 :	8.90 :	9.13 :	6.78 :	9.93
coconut	0.44 :	0.49 :	3.55 :	1.41 :	2.54 :	0.43 :	1.48
cabbage	0.24 :	0.26 :	0.40 :	0.75 :	0.71 :	0.32 :	0.45
other veg	0.29 :	0.12 :	0.24 :	0.05 :	0.37 :	0.08 :	0.19
other fruit	0.91 :	0.31 :	2.01 :	0.89 :	1.90 :	0.41 :	1.07
fresh meat	:	:	0.01 :	:	0.01 :	0.03 :	0.01
fresh fish	0.69 :	0.40 :	0.57 :	0.32 :	0.25 :	0.12 :	0.39
crab/shellfish	0.58 :	0.20 :	0.13 :	0.23 :	0.02 :	0.05 :	0.20
milk/eggs	0.01 :	:	:	:	0.00 :	:	0.00
betel nut	0.09 :	0.08 :	:	0.16 :	0.06 :	0.11 :	0.08
local tobacco	:	0.03 :	:	:	0.01 :	0.01 :	0.01

Based on observations from the following number of "household days":

1,200 960 480 840 1,200 720 900

Source: Statistics Office PBME unpublished results.

15.2 On average there are 9.93kg of staple crops produced daily, the crop composition varying according to area and season. Given a national mean household size of 6.50 from the 1986 population census this would provide each man, woman and child with approximately 1.5kg of staple per day.

15.3 The average household daily production of cabbage is 0.45kg, other vegetables 0.19kg and fruit 1.07kg. Only 0.01kg of fresh meat is consumed daily in comparison with 0.39kg (whole) fresh fish and 0.20kg crabs and shellfish. National coconut consumption is estimated to be 1.48kg husked unshelled nuts per day, which amounts to an average consumption of 4.26 nuts per household per day according to the mean nut weights in the survey.

15.4 Results from table 15.1 are transformed into annual production in table 15.2 using the simplifying assumption that the survey period is representative of the rest of the year. This is only a first approximation of smallholder yields.

Table: 15.2
ANNUAL SMALLHOLDER PRODUCTION

Average annual production from entire household (kg):

commodity	Province and Site						
	Ysabel	Central	Guadalcanal	Malaita	Makira	Temotu	Average
	Susubona	Hakama	Marau Sound	Afio	NW Peninsula	Lata	
sweet potato	2,919	974	2,439	1,382	1,492	1,528	1,789
cassava	460	357	786	129	231	15	330
yam	247	612	260	823	236	329	418
pana	212	1,677	116	23	123	44	366
taro	259	117	163	584	501	419	341
breadfruit	3		12	4		39	10
banana	201	204	674	304	750	101	372
sub-total	4,302	3,942	4,451	3,249	3,333	2,474	3,625
coconut (kg)	159	179	1,295	515	928	156	539
(nuts)	667	621	1,864	1,508	4,088	427	1,626
cabbage	88	94	145	274	261	117	163
other veg	107	43	87	17	136	28	70
other fruit	331	112	735	325	692	150	391
fresh meat			3		4	10	13
fresh fish	250	145	208	117	90	44	142
crab/shellfish	211	72	49	86	7	19	74
milk/eggs	2				0		0
betel nut	34	27		57	20	41	30
local tobacco		9			4	3	3

15.5 From table 9.2 the average root crop area in the survey area is 0.235ha of which sweet potato is dominant on 0.120ha, taro on 0.094ha, pana on 0.018ha and yam on 0.003ha. These crops occur in complex mixtures, so that simple cropping patterns can only be used as a first approximation for the actual crop coverage.

15.6 Table 15.3 is a summary of available production data from the farming systems survey and the PBME exercise. It is not possible to directly relate aggregate production data to average cropping patterns until a more detailed analysis of smallholder production is available.

Table: 15.3
SMALLHOLDER PRODUCTION SUMMARY

commodity	area (ha)	growing period (months)	annual production (kg)
sweet potato	0.120	4.1	1,492
cassava			15
yam	0.003	7.6	236
pana	0.018	7.6	123
taro	0.094	9.4	501
breadfruit			
banana			750
Source table:	9.2	11.3	15.2

Chapter: 16

LABOUR

16.1 With little or no cash inputs applied the main component in the socio-economy of smallholder agriculture is labour. Table 16.1 presents an overview of labour constraints expressed by farmers. The first part of the table shows the frequency of gardens affected and is expressed in terms of area affected in the second part. Labour constraints are illustrated in diagram 16.1.

Table: 16.1

LABOUR CONSTRAINTS

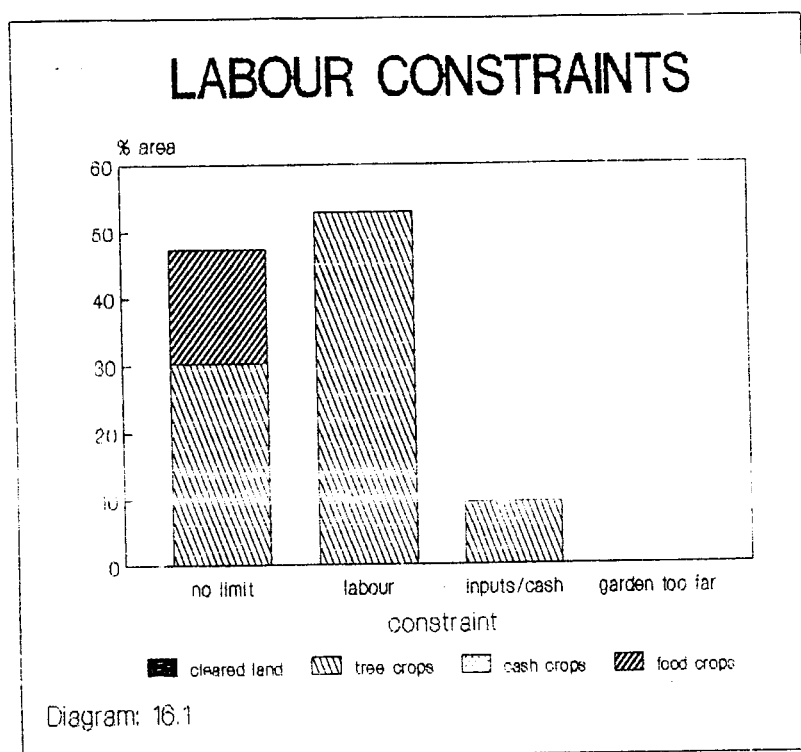
i) Labour Constraints by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no limitation		12		68	80
lack of labour		16		4	20
lack of inputs/cash					
lack of labour + cash		3			3
garden too far from house					
garden too far + labour				1	1
garden too far + cash					
too far + labour + cash					
total by crop type		31		73	104

ii) Labour Constraints by % cultivated area

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no limitation		30		17	47
lack of labour		43			43
lack of inputs/cash					
lack of labour + cash		9			9
garden too far from house					
garden too far + labour					
garden too far + cash					
too far + labour + cash					
total by crop type		83		17	100

Note: The table of % area is only approximate due to rounding small numbers



16.2 The dominant constraints are on tree crops. A labour shortage is recorded on 63% of the tree crop area, while a shortage of inputs or cash is recorded on 11% of the area. In contrast only 7% of food crop gardens, and on only a small part of the food crop area, have a shortage of labour. Despite quite high distances recorded in chapter 12, distance of gardens from households is not regarded as a problem except on one food crop garden.

16.3 Table 16.2 summarises the labour requirements of the average holding, derived from individual plot labour studies presented in annex 2. The table is a "model" budget representing the average of complex and diverse holdings. Individual crop budgets in annex 2 may be used to construct farm budgets for hypothetical holdings, but caution should be exercised where there are few observations. Labour days in budgets presented here are based on actual hours worked per day, which are quite variable. Again, tables in annex 2 may be used to convert work hours into "standard" work days if required. Since table 16.2 represents the average holding, crops which comprise only minor mixtures in cropping patterns do not appear in the summary labour budget.

16.4 The table shows the labour requirement of each agricultural operation according to crop, which may be a pure stand or more commonly the dominant crop in a mixture. Agricultural operations cover: land clearance; cultivation; planting; first, second and third weeding; and harvesting. For some crops - notably, but not exclusively, trees - there may be additional operations such as pruning or thinning which do not easily fall within the standard classification. Two general categories of establishment and maintenance operations are therefore included. Such a classification provides good coverage for most activities and allows diverse crops to be handled in a standard manner.

16.5 In the interpretation of labour budgets it should be remembered that only tree cropping farmers will require labour on tree crops while non-tree cropping farmers will not require any. Labour budgets are also presented on the basis of labour input "when operations are performed". Adjustment is not made to the labour input to take account of operations which are omitted. By referring to annex 2 adjustments may be made to budgets based on different assumptions about management intensity. Incorporating this into the present analysis would considerably increase the complexity of presentation and introduce ambiguity into the results.

Table: 16.2

ANNUAL LABOUR INPUT BY HOLDING

	<----- work days per year ----->				<- % contribution ->			labour	
	<----- per holding ----->				per ha				cost
	men	women	paid	total	average	men	women	paid	(SIS)
i) Land Clearance									
Cleared Land	1	1		2	132	50	50		
Coconut	38	8		46	48	83	17		
Cocoa	8	8		16	99	50	50		1
Grain crops					133				
Vegetable									
Fruit Crops									
Sweet Potato	14	8		22	185	64	36		
Taro	21	7	1	29	305	72	24	3	1
Yam	1			1	603	100			
Pana	3	1		4	222	75	25		
Total holding	86	33	1	120	229	72	28	1	2
ii) Cultivation									
Cleared Land					28				
Coconut	62	33		95	99	65	35		
Cocoa		32		32	189		100		
Grain crops					120				
Vegetable									
Fruit Crops									
Sweet Potato	13	8		21	174	62	38		
Taro	14	8		22	231	64	36		
Yam	1			1	464	100			
Pana	3			3	188	100			
Total holding	93	81		174	192	53	47		
iii) Planting									
Cleared Land									
Coconut	28			28	30	100			
Cocoa	11	6		17	99	65	35		
Grain crops					134				
Vegetable					274				
Fruit Crops					102				
Sweet Potato	9	10		19	157	47	53		
Taro	11	12		23	243	48	52		
Yam	2			2	663	100			
Pana	3	1		4	194	75	25		
Total holding	64	29		93	193	69	31		

ANNUAL LABOUR INPUT BY HOLDING (continued)

<----- work days per year -----> <- % contribution -> labour
 <----- per holding -----> per ha cost
 men women paid total average men women paid (SIS)

iv) Establishment

Cleared Land									
Coconut	1		1	1	100				
Cocoa									
Grain crops									
Vegetable									
Fruit Crops									
Sweet Potato									
Taro									
Yam									
Pana									
Total holding	1		1	1	100				

v) Maintenance

Cleared Land									
Coconut	29	7	1	37	40	78	19	3	5
Cocoa	2	2		4	20	50	50		
Grain crops									
Vegetable									
Fruit Crops									
Sweet Potato									
Taro									
Yam									
Pana									
Total holding	31	9	1	41	37	76	22	2	5

vi) First Weeding

Cleared Land									
Coconut	16			16	16	100			
Cocoa	1			1	8	100			
Grain crops									
Vegetable									
Fruit Crops									
Sweet Potato	1	8		9	83	11	89		
Taro	1	8		9	96	11	89		
Yam					215				
Pana	1	1		2	77	50	50		
Total holding	20	17		37	87	54	46		

ANNUAL LABOUR INPUT BY HOLDING (continued)

<----- work days per year -----> <- % contribution -> labour
 <----- per holding -----> per ha cost
 men women paid total average men women paid (SIS)

vii) Second Weeding

Cleared Land								
Coconut	7		7	7	100			
Cocoa								
Grain crops								
Vegetable								
Fruit Crops								
Sweet Potato	4	5	9	72	44	56		
Taro	2	2	4	42	50	50		
Yam								
Pana								
Total holding	13	7	20	40	65	35		

viii) Third Weeding

Cleared Land								
Coconut	5		5	5	100			
Cocoa								
Grain crops								
Vegetable								
Fruit Crops								
Sweet Potato								
Taro								
Yam								
Pana								
Total holding	5		5	5	100			

ix) Harvesting

Cleared Land								
Coconut								
Cocoa	16	16	32	186	50	50		
Grain crops								
Vegetable								
Fruit Crops								
Sweet Potato	10	27	37	310	27	73		
Taro		15	15	159		100		
Yam	1	1	2	713	50	50		
Pana	2	1	3	159	67	33		
Total holding	29	60	89	282	33	67		

16.6 A high proportion of labour is expended on land preparation for and the planting of coconuts and cocoa. Coconuts account for 38% of the labour expended in land clearance, requiring 46 work days per year, while cocoa accounts for 13% of land clearance labour requiring 16 days. Root crops account for a further 47% of labour expended, requiring 56 days mainly on sweet potato and taro. Of 120 work days, men contribute 72%, women 28% and paid labour accounts for 1%.

16.7 Coconuts account for 73% of the labour expended on cultivation, requiring 127 work days. A further 47 work days are required on root crops, or 27% of the labour budget. Of 174 work days per year men contribute 53% and women contribute 47%. Surprisingly, women provide a high proportion of the labour on land clearance for coconuts and cocoa while men provide a high proportion of the labour on land clearance for root crops.

16.8 48% of the labour expended in planting is on coconuts and cocoa, accounting for 45 work days per year, with a further 48 work days, or 52% of the labour budget on root crops. Of 93 work days per year required on planting men contribute 69% while women contribute 31%.

16.9 One labour day is expended on the establishment of coconuts. 41 days per year are expended on the maintenance of coconut and cocoa for which men contribute 76% of labour, women contribute 22%, and 2% is accounted for by hired labour.

16.10 37 work days are spent on the first weeding of crops, of which 17 days are accounted for by coconuts and cocoa, and 20 days by root crops. Men contribute 54% of the labour on first weeding compared with 46% from women.

16.11 20 work days are spent on the second weeding of crops, of which 7 days are on the brushing of coconuts, 9 days on sweet potato and 4 days on taro. Men provide 65% of the labour on second weeding and women provide 35%.

16.12 5 work days are spent on the third brushing of coconuts by men.

16.13 The harvesting budget is underestimated since it was not possible to obtain data on coconuts. 89 work days are spent on harvesting, mostly by women and mostly on root crops which

account for 64% of the budget. Men provide 33% of labour in harvesting compared with 67% from women.

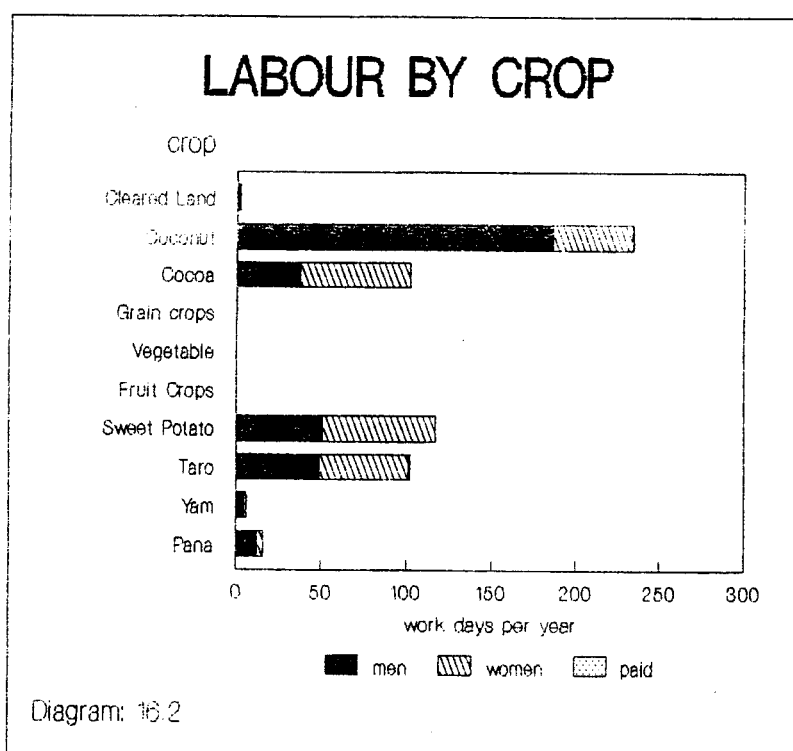
16.14 Overall men provide 59% of labour and women provide 41% of farm labour. Table 16.3 presents a summary of labour by crop and by operator.

16.15 There are 580 work days per year required on an "average" holding of which 342 are provided by men, 236 by women and 2 by hired labour. The average adult man in the household spends 182 days working on the holding and the average adult woman spends 126 days.

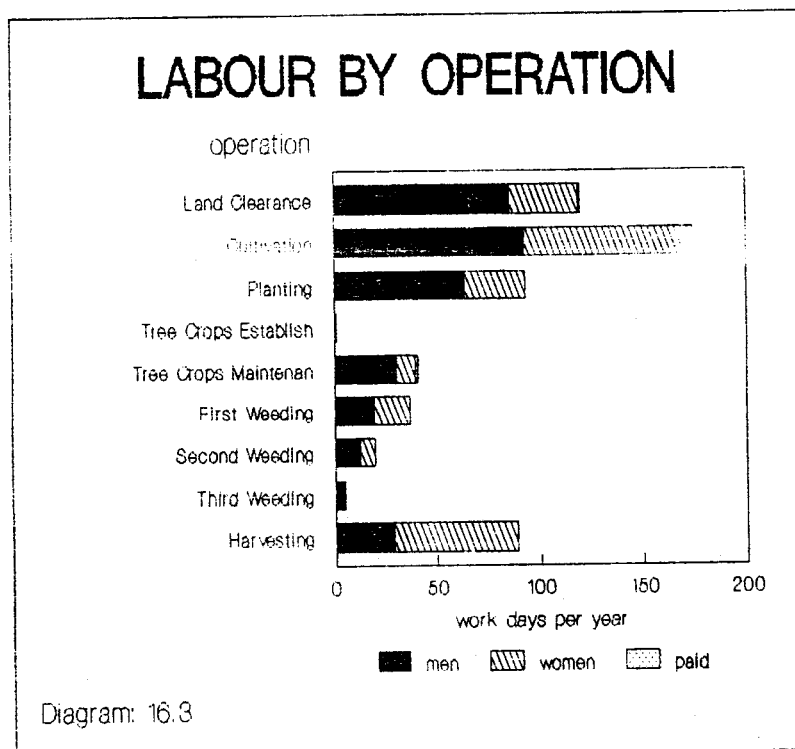
Table: 16.3
SUMMARY OF LABOUR INPUT

	<----- work days per year ----->					<- % contribution ->			labour
	<----- per holding ----->				per ha				cost
	men	women	paid	total	average	men	women	paid	(SIS)
i) By Crop									
Cleared Land	1	1		2					
Coconut	186	48	1	235	246	79	20	0	5
Cocoa	38	64		102	601	37	63		1
Grain crops					387				
Vegetable					274				
Fruit Crops					102				
Sweet Potato	51	66		117	981	44	56		
Taro	49	52	1	102	1076	48	51	1	1
Yam	5	1		6	2658	83	17		
Pana	12	4		16	840	75	25		
All Crops	342	236	2	580		59	41	0	7
ii) By Operation									
Land Clearance	86	33	1	120		72	28	1	2
Cultivation	93	81		174		53	47		
Planting	64	29		93		69	31		
Tree Crops Establishment	1			1		100			
Tree Crops Maintenance	31	9	1	41		76	22	2	5
First Weeding	20	17		37		54	46		
Second Weeding	13	7		20		65	35		
Third Weeding	5			5		100			
Harvesting	29	60		89		33	67		
All Operations	342	236	2	580		59	41	0	7
Available labour units	:1.88	1.88							
Days per unit labour	: 182	126	2						

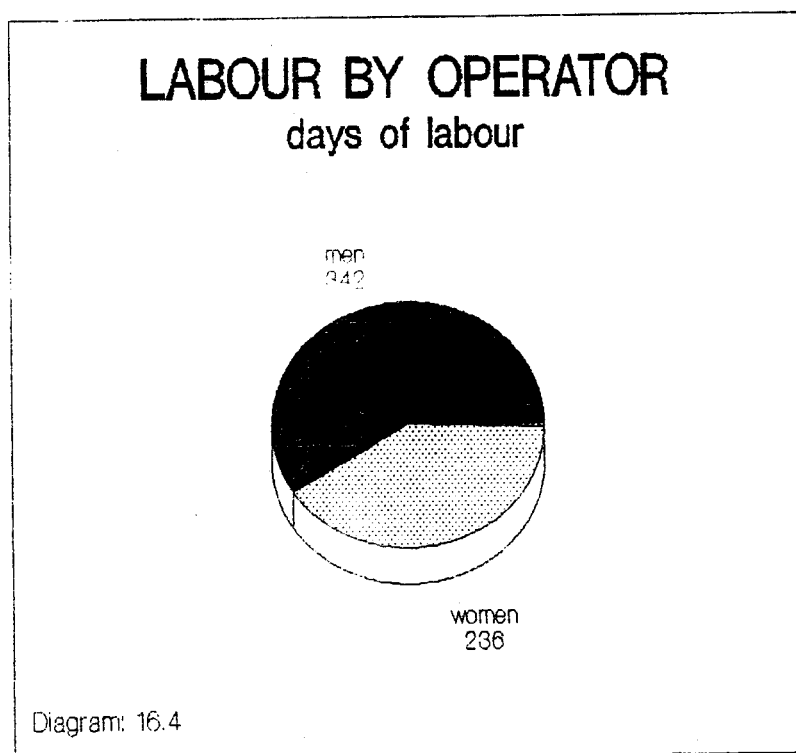
16.16 Labour by crop is illustrated in diagram 16.2. Coconut accounts for 41% of the holding labour budget and cocoa accounts for 18%. Sweet potato accounts for 20%, taro 18%, yam 1% and pana 3%. Overall tree crops account for 58% of the annual labour budget and food crops account for 42%.



16.17 Labour by operation is illustrated in diagram 16.3. Men and women share most operations. Of the annual labour budget of 580 days, land clearance accounts for 21% of labour expended, cultivation accounts for 30%, planting 16%, establishment and maintenance 7%, weeding 10% and harvesting 15%.



16.18 Diagram 16.4 illustrates the contribution from men, women and hired labour. Men contribute 59% of labour on farm and women provide 41%.



Chapter: 17

CROP AND FARM BUDGETS

17.1 It is not possible at this stage to produce comprehensive crop and farm budgets because of the complexity and diversity of cropping patterns, and production data are as yet incomplete. The main elements are available and a summary of information on cropping patterns, production and labour is presented in Table 17.1.

Table: 17.1
ELEMENTS OF A FARM BUDGET

main crop in mixture	area (ha)	annual production (kg)	annual labour	
			work days	cost (SIS)
a Cleared Land	0.017			
b Coconut	0.959	928	235	5
c Cocoa	0.170		102	1
z Coconut and Cocoa				
d Pasture				
e Grain Crops	0.001			
f Beans				
g Cabbage		261		
h Vegetables	0.001	136		
i Spices				
j Fruit Crops	0.004	692		
k Fruit trees				
l Banana		750		
m Citrus trees				
n Nut trees		20		
o Sugar cane				
p Food/building tree				
q Tobacco		4		
r Sweet Potato	0.120	1,492	117	
s Taro	0.094	501	102	1
t Yam	0.003	236	6	
u Pana	0.018	123	16	
v Cassava		231		
w Other root crop				
Total	1.386		580	7
Table reference	9.2	15.2	16.3	16.3

Chapter: 18

CASH CROP PROCESSING

18.1 Table 18.1 presents a labour budget for the production of copra based on 9 observations. The labour composition is 64% family and 36% hired at an annual cash cost of SI\$21.7. Hired labour is employed mainly in collecting nuts while all operations are performed by family labour.

18.2 Copra manufacture requires 114 work days per annum to produce 692kg copra, or one work day per 6kg copra produced. 81 work days are spent on picking and shelling the nuts which account for 71% of the total production time. Firewood collection takes 18 days or 16% of the time; and drying, bagging and transport take 14 days or 13% of the time. The annual labour input is illustrated in diagram 18.1.

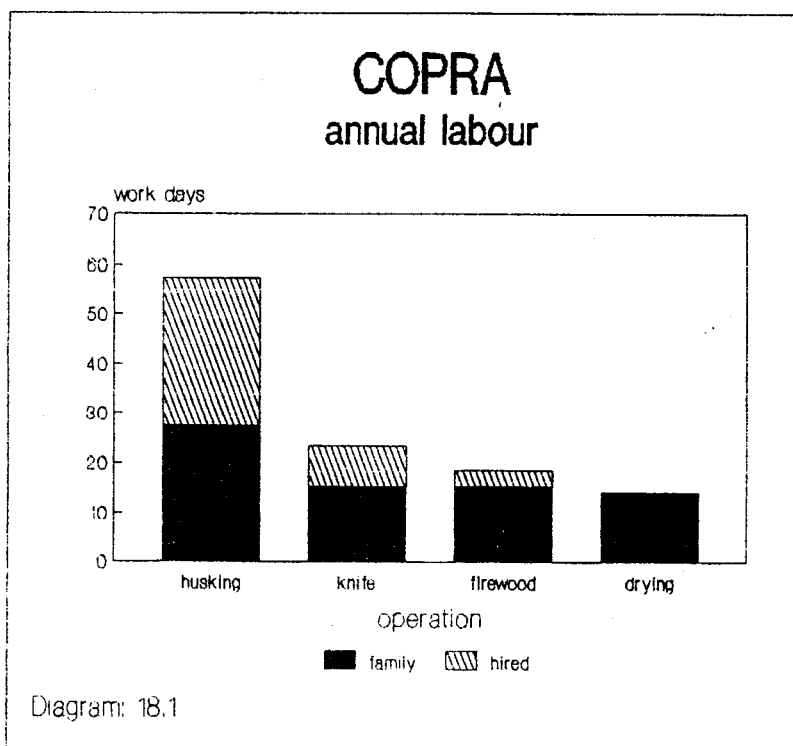


Table: 18.1

ANNUAL COPRA PRODUCTION AND LABOUR EXPENDITURE

Annual Labour Expenditure		family or shared labour		hired labour		total	% labour by operation
		work hours	work days	work days	cash cost (\$/c)	work days	
HUSKING	picking, heaping	8.3	1.7	29.9	4.35	31.6	22
	husking	51.7	10.0			10.0	7
	transport	32.6	5.3			5.3	4
	breaking	32.6	5.3			5.3	4
	shelling	36.4	5.3			5.3	4
total		161.7	27.5	29.9	4.4	57.5	40
COPRA KNIFE	picking, heaping	37.2	6.3	2.7	5.33	9.0	6
	axing + copra knife	26.2	4.3	2.8	4.67	7.1	5
	transport	28.4	4.6	2.8	4.67	7.4	5
total		91.7	15.2	3.2	14.7	23.5	16
FIREWOOD	collection	37.2	7.4			7.4	5
	transport	35.5	7.2	2.2	0.44	9.4	6
	collection + transport	4.0	0.7	1.0	2.26	1.6	1
total		76.7	15.3	3.2	2.7	18.4	13
DRYING	drying	93.5	9.2			9.2	6
	bagging	12.7	4.2			4.2	3
	transport	2.5	0.8			0.8	1
total		108.7	14.2			14.2	10
TOTAL		438.8	72.2	41.3	21.7	113.5	100
% labour by type of labour			64	36		100	

copra grade	quantity of copra produced (kg)	
	per annum	per work day
Grade 1	685	6
Grade 2	7	0
Grade 3		
Ungraded		
total	692	6

Number of observations = 9

18.3 The gross margin for copra production is summarised in table 18.2. From an annual production of 692kg valued at the prevailing price of 33 cents per kilo the gross return is SI\$228. Inputs costs from bags and twine amount to SI\$10.20 and labour costs are SI\$21.70. The net income is SI\$196 which, at a requirement of 72 household labour days, represents a net return to labour of SI\$2.72 per household work day.

Table: 18.2
COPRA GROSS MARGIN

Annual production (kg)	692
Price per kilogram (SI\$)	0.33
Gross return (SI\$)	228
Inputs cost (SI\$)	10.20
Labour cost (SI\$)	21.70
Net return (SI\$)	196
Household labour days	72
Copra production per household work day (kg)	9.6
Net return per household work day (SI\$)	2.72

Inputs costs: Sacks @ SI\$1.00 per new sack;
Average packed weight 70kg = 10 sacks = SI\$10.00.
Twine @ SI\$1.00 per hank of 50 strings = SI\$0.20.

18.4 Table 18.3 presents the budget for cocoa production undertaken by 2 sampled farmers.

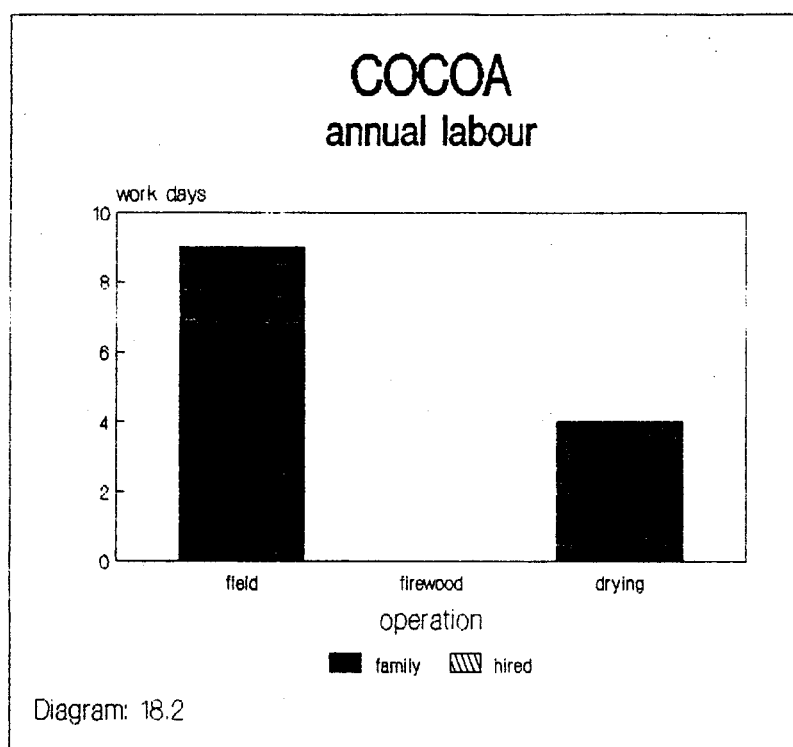
Table: 18.3
ANNUAL COCOA PRODUCTION AND LABOUR EXPENDITURE

Annual Labour Expenditure		family or shared labour		hired labour		total	% labour by operation
		work hours	work days	work days	cash cost (\$c)	work days	
FIELD	harvesting	8.0	3.0			3.0	23
	breaking pod	7.0	3.0			3.0	23
	transport	5.0	3.0			3.0	23
	total	20.0	9.0			9.0	69
FIREWOOD	collection						
	transport						
	collection + transport						
DRYING	total						
	fermenting						
	drying						
	bagging	0.2	2.0			2.0	15
	transport	10.0	2.0			2.0	15
	total	10.2	4.0			4.0	31
TOTAL		30.2	13.0			13.0	100
% labour by type of labour		100				100	

cocoa	quantity of cocoa produced (kg)	
	per annum	per work day
Green beans	365	28
Dry beans		
total	365	28.1

Number of observations = 2

18.5 13 family work days were expended in the production of 365kg cocoa green beans. Labour expenditure in the production of cocoa is illustrated in diagram 18.2.



18.6 The gross margin for cocoa is shown in table 18.4. An annual production of 365kg of cocoa at the prevailing price of SI\$0.70 per kilo green beans provides a net return of SI\$256, representing a return to labour of SI\$20 per family day worked.

Table: 18.4
COCOA GROSS MARGIN

Annual production green beans (kg)	365
Price per kilogram (SI\$)	0.70
Gross return (SI\$)	256
Annual production dry beans (kg)	
Price per kilogram (SI\$)	1.70
Gross return (SI\$)	
Green and dry beans gross return (SI\$)	256
.....	
Inputs cost (SI\$)	6.12
Labour cost (SI\$)	
.....	
Net return (SI\$)	250
.....	
Household labour days	13
Cocoa production per household work day (kg)	28
Net return per household work day (SI\$)	19.96

Inputs costs: Sacks @ SI\$1.00 per new sack;
Average packed weight 65kg = 6 sacks = SI\$6.00;
Twine @ SI\$1.00 per hank of 50 strings = SI\$0.12.

Chapter: 19

MARKETING

19.1 Table 19.1 presents a summary of marketing data collected in the survey, listing crops marketed against the number of observation recorded. The mean weight marketed is recorded, the time taken to go to market and back, the number of times the commodity is marketed per year, and the number of people involved in marketing. These are grouped under the heading of "marketing" details.

19.2 Marketing costs are recorded under the headings of freight or transport costs, fares for people involved in marketing, and market tax which may be imposed at the point of sale.

19.3 Revenues are possible where wages are earned, for instance from selling other farmers' produce and from the sale of crops. It is often difficult for sellers to specify costs and revenues, and in such cases data have to be treated as "missing". Thus the number of observations for crop sales may be lower than those for marketing data.

19.4 Table 19.2 is a transformation of the raw marketing data into an "average" annual marketing budget. The data are incomplete because of difficulties in recalling weights sold and marketing revenues. It is presented not as a model marketing budget, but as a data set to provide as much information on marketing as possible, albeit with gaps.

19.5 The two right-most columns show the net marketing revenue by crop and by household. The "net marketing revenue by crop" is the net return from sales after deducting costs. It is not the average income from crop sales since revenue may be negative where income data are missing or as a result of the double counting of transport costs when freight expenses are shared among several crops.

19.6 The "net marketing revenue per household" is the average household earnings taking account of the proportion of households selling each type of crop, but based on the limitations of the crop revenue data.

Table: 19.1
MARKETING TIME AND CROP PRICES

Basic Marketing Data:

Basic Marketing Data:		<----- marketing ----->				<----- costs ----->			<-- revenues -->			
		number of obs	mean weight marketed	time to market and back	times marketed per year	number of people	freight/ of transport cost	fares for people	market tax	wages earned	crop sale price	crop sale obs
		(obs)	(kg)	(days)	(times)	(people)	(\$/S)	(\$/S)	(\$/S)	(\$/S)	(\$/kg)	(obs)
ALL CROPS	Average	47	148	0.8	3	2	0.30		1.53		0.72	47
COCONUT	Coconut (copra made)	1	232		1	1					0.23	1
	Copra	8	667	0.5	2	1	1.75		9.00		0.28	8
COCOA	Green Beans	2	148	0.5	3	1					1.08	2
ROOT CROPS	Sweet Potato	9	46	0.9	5	1					0.14	9
	Taro Common	1	52	0.1	10	2					0.15	1
	Hong Kong	2	120	1.0	3	3					0.06	2
	Yam	1	20	1.0	1	1					0.25	1
GRAIN CROPS	Corn	1	4	1.0	2	4					0.50	1
BEANS	Long Bean	2	3	1.0	2	2					0.23	2
CABBAGE	Hibiscus Cabbage	3	51	1.0	5	2					1.09	3
	Chinese Cabbage	1	1	1.0	2	2					2.00	1
VEGETABLES	Shallot	3	4	0.7	4	2					2.33	3
FRUIT CROPS	Pineapple	2	10	1.0	6	2					0.13	2
BANANA	Cooking Banana	5	27	0.8	2	2					0.30	5
	Sweet Banana	2	22	1.0	4	3					0.30	2
NUT TREES	Ngali Nut	1	0.3	1.0	2	1					1.00	1
	Betel Nut	1	0.2	1.0	4	1					10.00	1
SUGAR CANE	Sugar Cane	2	5	1.0	3	3					0.40	2
Number of households		39										

Table: 19.2
INCOME FROM MARKETING

Annual Marketing Budget:

Annual Marketing Budget:		<----- costs (SIS) ----->						<--- revenues (SIS) --->		net	net		
		% weight houses marketed marketing crop (%)	kg (kg)	man transport days (days)	freight/ cost (SIS)	fares for people (SIS)	market tax (SIS)	total marketing costs (SIS)	wages earned (SIS)	crop sales (\$/kg)	total revenue (SIS)	marketing revenue by crop (SIS)	marketing revenue per household (SIS)
ALL CROPS	Average		499	4.4	1		5	6.15		359.32	359.32	353	134
COCONUT	Coconut (copra made)	3	232							52.99	52.99	53	1
	Copra	21	1334	0.9	4		18	21.50		376.38	376.38	355	73
COCOA	Green Beans	5	369	0.6						397.44	397.44	397	20
ROOT CROPS	Sweet Potato	23	227	5.8						32.26	32.26	32	7
	Taro Common	3	520	1.0						78.00	78.00	78	2
	Hong Kong	5	300	7.5						18.75	18.75	19	1
	Yam	3	20	1.0						5.00	5.00	5	0
GRAIN CROPS	Corn	3	8	8.0						4.00	4.00	4	0
BEANS	Long Bean	5	6	4.0						1.35	1.35	1	0
CABBAGE	Hibiscus Cabbage	8	255	11.7						276.83	276.83	277	21
	Chinese Cabbage	3	1	4.0						2.80	2.80	3	0
VEGETABLES	Shallot	8	18	4.6						41.07	41.07	41	3
FRUIT CROPS	Pineapple	5	54	11.0						7.15	7.15	7	0
BANANA	Cooking Banana	13	54	3.2						16.32	16.32	16	2
	Sweet Banana	5	89	10.0						26.90	26.90	27	1
NUT TREES	Ngali Nut	3	1	2.0						0.60	0.60	1	0
	Betel Nut	3	1	4.0						6.00	6.00	6	0
SUGAR CANE	Sugar Cane	5	14	7.5						5.40	5.40	5	0

19.7 Table 19.3 shows the time taken to different markets and the type of crop sold at each market. The classification of markets is subject to local interpretation, where "central" would generally be the provincial capital.

Table: 19.3
MARKET LOCATION

market location:	local	inter- mediate	central	Honiara	trading ship	% obs	numbe of obs
i) Time taken to market produce							
time taken to go to market and back (days)	(% observations)						
0 - .5	17				9	26	12
.5 - 1	30	38			2	70	33
1 - 2			2	2		4	1
2 - 5							
5 - 10							
> 10							
% observations	47	38	2	2	11	100	
number of observations	22	18	1	1	5	47	47
mean time (days)	0.65	1.00	2.00	2.00	0.20		1.75

this table is continued on the next page

market location:		local	inter- mediate	central	Honiara	trading ship	% obs	number of obs
ii) Crops sold at different markets		(% observations)						
COCONUT	Nuts to make copra	2					2	1
	Copra	4			2	11	17	8
COCOA	Green Beans	4					4	2
ROOT CROPS	Sweet Potato	15	2	2			19	9
	Taro Common	2					2	1
	Hong Kong		4				4	2
	Yam	2					2	1
GRAIN CROPS	Corn		2				2	1
BEANS	Long Bean		4				4	2
CABBAGE	Hibiscus		6				6	3
	Chinese		2				2	1
VEGETABLE	Shallot	2	4				6	3
FRUIT CROPS	Pineapple	2	2				4	2
BANANA	Cooking Banana	6	4				11	5
	Sweet Banana	2	2				4	2
NUT TREES	Ngali Nut	2					2	1
	Betel Nut		2				2	1
SUGAR CANE	Sugar Cane	2	2				4	2
% observations		47	38	2	2	11	100	
number of observations		22	18	1	1	5		47

19.8 Table 19.4 summarises crop price perception and sale volumes.

Table: 19.4

CROP PRICE PERCEPTION AND SALE VOLUMES

		<---- sale price ---->			<----- sale volume ----->			number of
		poor	average	good	little	average	more than usual	obs
COCONUT	Nuts	100				100		1
	Copra	25	63	13	38	63		8
COCOA	Green Beans		100			100		2
ROOT CROPS	Sweet Potato	11	89		56	44		9
	Taro Common		100			100		1
	Hong Kong		100		50	50		2
	Yam		100		100			1
GRAIN CROPS	Corn		100			100		1
BEANS	Long Bean		100		50	50		2
CABBAGE	Hibiscus Cabbage		100		33	67		3
	Chinese Cabbage		100		100			1
VEGETABLES	Shallot		100		33	67		3
FRUIT CROPS	Pineapple		100		50	50		2
BANANA	Cooking Banana		100		60	40		5
	Sweet Banana		100			100		2
NUT CROPS	Ngali Nut		100		100			1
	Betel Nut		100		100			1
SUGAR CANE	Sugar Cane		100		50	50		2
Number of observations		4	42	1	21	26		47

19.9 Sale volumes are generally low to average while prices were generally felt to be average. Local market prices were unavailable during the survey.

19.10 Table 19.5 summarises marketing problems. To the right of the table are the proportion of cases by severity of problem. These are combined with crop type in the body of the table to show the "index of severity". In this index "no problem" is weighted "0", "slight problem" is weighted "0.5", and "severe problem" is weighted "1.0". Thus if all cases registered a severe problem the index would be "1.0".

Table: 19.5
MARKETING PROBLEMS

Number of observations = 47

	<----- crop type ----->			<----- severity of ----->		
	coconut and cocoa	root crops	other crops	none	slight	severe
	(index of severity)			(% cases)		
terrain too difficult	0.0	0.1	0.1	60	26	15
distance too great	0.0	0.1	0.2	55	30	15
not enough time/labour	0.1	0.1	0.1	64	34	2
transport cost too high	0.0		0.0	94	6	
low price at market	0.1	0.1	0.1	51	40	9
lack of transport	0.1	0.0	0.1	83	2	15
unreliable transport	0.0			96	4	
risk of not selling enough	0.0	0.0	0.1	81	11	9
crop damage in transit				100		
administrative restrictions				100		
quarantine control				100		
other problem				100		

Note: "Index of Severity is a weighted summary of severity of marketing problems.
It falls in the range 0 to 1 where 0.0 = no marketing problem
0.5 = slight marketing problem
1.0 = severe marketing problem

19.11 Marketing problems mostly slight, but terrain and distance, labour shortage, low prices, lack of transport and risk of not selling enough are all problems.

Annex: 1

CROP NAMES AND CODES

A1.1 The following list describes the hierarchical coding sequence used by AES in farming systems surveys to describe crop types. The list may be added to by inserting other crops of interest within the appropriate category.

A1.2 At the garden level only broad distinctions are made between cleared land, tree crops, short term cash crops, and food crops. Only single digit numeric codes are permitted at this level and these do not distinguish between crop type or mixtures. They do, however, provide important information about the structure of the holding. Code "1" for instance specifies "tree crops".

A1.3 At the plot level alphabetical codes are used to describe crop mixtures. These are used to describe cropping patterns and the analysis of labour by crop. Letter codes are strung together so there is no pre-set limit on the complexity of mixtures described. Some simplification is introduced within the code categories themselves. The dominant crop is listed first and other crops are listed to the right in decreasing order of importance. The string code then takes the form of an alphabetical "number", where the most significant characters are to the left and the least significant to the right. For instance "a" specifies "cleared land", while "rvgfl" specifies a mixture in decreasing order of importance of "sweet potato, cassava, cabbage, beans, banana".

A1.4 At the yield and marketing levels it is necessary to specify exactly the crop under study, and so a unique three-digit numeric code is assigned to each crop. The list need not be complete and may be added to as necessary since "spare codes" are available. For instance "613" specifies "pineapple".

Table: A1.1
CROP NAMES AND CODES

garden		plot	yield and marketing		scientific name
code	name	code	code	name	
0	cleared	a	100	CLEARED (unplanted)	
1	tree crops	b	200	COCONUT	<u>Cocos nucifera</u>
			210	Local Tall	
			211	Rennel	
			212	Dwarf Hybrid	
			219	Other	
			250	Copra	
1	tree crops	c	300	COCOA	<u>Theobroma cacao</u>
			310	Cocoa green beans	
			311	Cocoa dry beans	
		d		Pasture	
3	food crops		400	ROOT CROPS	
		r	410	Sweet Potato	<u>Ipomoea batatas</u>
		s	411	Taro Common	<u>Colocasia esculenta</u>
		s	412	Giant	<u>Alocasia micorhiza</u>
		s	413	Hong Kong	<u>Xanthosoma saggitifolium</u>
		s	414	Swamp	<u>Cytosperma chamissonis</u>
		t	415	Yam	<u>Dioscorea alata</u>
		u	416	Pana	<u>Dioscorea esculenta</u>
		v	417	Cassava	<u>Manihot esculenta</u>
		w	419	Other root crop	
3	food crops	e	430	GRAIN CROPS	
			431	Corn	<u>Zea mays</u>
			432	Peanuts	<u>Arachis hypogaea</u>
			439	Other grain crop	
3	food crops	f	440	BEANS	
			441	Long bean	<u>Phaseolus vulgaris</u>
			442	Wing bean	<u>Psophocarpus tetragonolobus</u>
			443	Snake bean	<u>Trichosanthes cucumerina</u>
			444	Mung bean	<u>Phaseolus aureus</u>
			445	Pigeon pea	<u>Cajanus cajan</u>
			449	Other bean	

3	food crops	g	450	CABBAGE	
			451	Hibiscus cabbage	<u>Hibiscus manihot</u>
			452	Kangkong	
			453	Chinese cabbage	<u>Brassica chinensis</u>
			454	English cabbage	<u>Brassica campestris</u>
			455	Watercress	
3	food crops	h	459	Other cabbage	
			460	VEGETABLE	
			461	Pumpkin	<u>Cucurbita maxima</u>
			462	Cucumber	<u>Cucumis sativus</u>
			463	Shallot	<u>Allium spp.</u>
			464	Onion	<u>Allium cepa</u>
			465	Tomato	<u>Lycopersicon esculentum</u>
			466	Okra	<u>Hibiscus esculentus</u>
			467	Egg plant	<u>Solanum melongena</u>
			468	Green pepper (sweet)	<u>Capsicum annuum</u>
			479	Other vegetable	
2	short term cash crops	i	500	SPICES	
			511	Chilli pepper	<u>Capsicum spp.</u>
			512	Pepper corn	<u>Piper nigrum</u>
			513	Turmeric	<u>Curcuma domestica</u>
			514	Cardamom	<u>Ellettaria cardamomum</u>
			515	Cinnamon	<u>Cinnamomum zeylanicum</u>
			516	Ginger	<u>Zingiber officinale</u>
			517	Garlic	<u>Allium sativum</u>
			518	Vanilla	<u>Vanilla fragrans</u>
			529	Other spice	
2/3	cash/food crops	j	600	FRUIT CROPS	
			611	Water melon	<u>Citrullus lanatus</u>
			612	Rock melon	
			613	Pineapple	<u>Ananas comosus</u>
			614	Paw Paw	<u>Carica papaya</u>
			615	Passion fruit	<u>Passiflora edulus f. flavicarpa</u>
			619	Other fruit crop	
1	tree crops	k	620	FRUIT TREES	
			621	Guava	<u>Psidium guajava</u>
			622	Mango	<u>Mangifera indica</u>
			623	Soursop	
			624	Local Apple	
			625	Malayan Apple	<u>Eugenia malaccensis</u>
			626	Avocado	<u>Persea americana</u>
			629	Other fruit tree	

3	food crops	l	630 BANANA	<u>Musa spp.</u>
			631 Cooking banana	
			632 Sweet banana	
			639 Other banana	
1	tree crops	m	640 CITRUS TREES	
			641 Orange	<u>Citrus sinensis</u>
			642 Lime	<u>Citrus aurantifolia</u>
			643 Grapefruit	<u>Citrus paradisi</u>
			644 Pomelo	<u>Citrus grandis</u>
			649 Other citrus	
1	tree crops	n	650 NUT TREES	
			651 Ngali Nut	<u>Canarium spp.</u>
			652 Cut Nut	<u>Barringtonia spp.</u>
			653 Betel Nut	<u>Areca catechu</u>
			654 Cashew Nut	<u>Anacardium occidentale</u>
			655 Alite Nut	<u>Terninalia catappa</u>
			659 Other Nut	
2	short term cash crops	o	660 SUGAR CANE	
			661 Sugar cane	<u>Saccharum spp.</u>
			662 Pit Pit	<u>Saccharum edule</u>
			669 Other	
1	tree crops	p	700 FOOD/BUILDING TREE	
			701 Breadfruit	<u>Artocarpus altilis</u>
			702 Sago palm	<u>Metroxylon spp.</u>
			703 Bamboo	<u>Nastus spp.</u>
			709 Other tree	
2	short term cash crops	q	800 Tobacco	<u>Nicotiana tabacum</u>

Annex: 2

LABOUR BUDGETS

A2.1 Summaries of labour in the main body of the report are derived from labour budgets shown in tables A2.1 to A2.9, each covering a major land or crop operation.

<u>Table</u>	<u>Operation</u>
A2.1	Land Clearance
A2.2	Cultivation
A2.3	Planting
A2.4	Tree Crops Establishment
A2.5	Tree Crops Maintenance
A2.6	First Weeding
A2.7	Second Weeding
A2.8	Third Weeding
A2.9	Harvesting

A2.2 Each table is divided into two sub-tables, named "a" and "b". Part "a" expresses budgets in the form of labour per hectare. Part "b" converts these results to labour per holding, based on mean holding sizes previously derived.

A2.3 Tables in "part a" are divided into two main components. Part "i" expresses "labour input by main crop growing in the plot". This is the measured labour input from field data and is derived from a subsample of plot observations. To the left of the table is the main crop type, which is the dominant crop in a mixture. In the first column of the table is the number of plots on which observations were made, and in the second column is the mean area of observed plots. The third column summarises the average number of times per year that the operation is performed in a cropping sequence, and the fourth column expresses the average number of hours worked per day.

A2.4 Within the box are labour data expressed in terms of seasonal (single crop) and annual (crop sequence) labour input, broken down by men, women and paid labour. The wage cost of paid labour is shown in the right-most column. In this, hours are converted to days by dividing by the average number of hours worked per day. This then takes account of "unproductive" time such as for travel to and from the garden, and expresses labour in terms of actual time taken. It does not, however, take account of different agricultural operations which may take place on the same day for instance where a morning might be spent clearing a plot while the afternoon is spent in weeding. Commonly work is split between the cool hours of the morning and late afternoon and so such circumstances should not generally arise.

A2.5 Below is "part ii" of the table, in which the composition of labour input is shown in more detail. The first four columns show the average number of workers in each category. Within the box is a summary of the table above, in which the % contribution of men, women and paid labour is shown.

A2.6 "Part b" of the table is on the page following "part a", in which annual labour per hectare is converted to annual labour per holding based on mean holding areas recorded for each given crop and operation - since each sub-sample will differ from the others. These are shown in the upper part of the table in two forms, as work hours and as work days by category of labour. The annual wage labour cost is shown in the far right column of the table.

A2.7 Below is the labour budget expressed in terms of time per household labour unit. In this it is assumed that communal labour is reciprocated and so balances out. Total labour input may therefore be expressed simply in terms of family labour. Wage labour is external and is therefore given the adult equivalent "weighting" of 1. Family labour is weighted according to the age composition of the family, analysed in chapter 3.

A2.8 Each set of tables for an operation is accompanied by a diagram in which the annual days of labour per holding are summarised by crop and by labour category.

A2.9 Various points should be noted about the derivation of labour budgets:

i) They are expressed in the form of "models" which are based on a sub-sample of observations. These are derived from interview, not direct measurement, although care is taken to minimise recall periods. Labour budgets are built up from a mosaic of labour records.

ii) Crop categories are summaries of complex mixtures in which the crop listed is dominant. Labour data are thus compatible with cropping pattern data and represents actual field conditions. No attempt is made to restrict or control the conditions under observation.

iii) Each table shows the labour input for an operation which is conducted. The tables do not show the extent to which operations may be missed or combined. Such refinements are difficult to include without a more complex, and therefore more costly and time consuming, survey design. The analysis therefore tends to be conservative since it does not take account of possible economies in combined operations.

iv) Caution should be exercised in interpreting results from few observations since labour data on complex systems are very variable.

v) Labour, although of central importance in the agricultural economy, is not necessarily economically optimising. Often labour has an important social character in which households will group together and "share" labour. Differences in site and labour composition, together with the social character of some labour, introduce considerable variability into results.

Table: A2.1

LABOUR OPERATIONS ON LAND CLEARANCE (per hectare)

					----- labour input ----- <--- per season ----> <--- per year --> <----- hours/ha -----> hours days men women paid (hrs/ha) (d/ha) (\$/ha/yr)						labour cost
number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day								
i) Labour input by main crop growing in the plot											
All plots summary :	101	0.145	1.00	6.1	990	378	26	1394	229	5.26	
Cleared land a:	5	0.058	1.00	6.4	521	324		845	132		
Coconut b:	6	0.670	1.00	6.8	269	59		328	48		
Cocoa c:	7	0.775	1.00	5.0	248	235	12	495	99	5.88	
Grain crops e:	2	0.012	1.00	2.0	77	189		266	133		
Sweet potato r:	30	0.059	1.00	6.3	748	401	14	1163	185	4.13	
Taro s:	32	0.075	1.00	5.9	1309	416	66	1791	305	11.44	
Yam t:	4	0.016	1.00	6.8	3203	867		4070	603		
Pana u:	15	0.041	1.00	6.7	1118	360		1478	222		
ii) Labour composition											
<- average number of workers ->					<-- % contribution -->						
	men	women	paid	total	men	women	paid				
All plots summary :	2.0	1.1	1.3	4.4	71	27	2				
Cleared land a:	1.2	0.6		1.8	62	38					
Coconut b:	3.5	1.5		5.0	82	18					
Cocoa c:	2.7	1.9	2.6	7.1	50	47	2				
Grain crops e:	0.5	0.5		1.0	29	71					
Sweet potato r:	1.8	1.5	0.9	4.2	64	34	1				
Taro s:	2.2	0.7	2.8	5.6	73	23	4				
Yam t:	2.0	1.0		3.0	79	21					
Pana u:	1.5	0.9		2.5	76	24					

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
 2. "Hours per year" is the sum of hours per season multiplied by times per year.

LABOUR OPERATIONS ON LAND CLEARANCE (per holding)

i) Total time worked

	mean holding area (ha)	<----- work hours ----->			<----- work days ----->				labour cost (SIS)
		men	women	paid	men	women	paid	total	
Total	: 1.386	552	199	10	87	33	2	122	3
Cleared land	: 0.017	9	6		1	1		2	
Coconut	: 0.959	258	57		38	8		46	
Cocoa	: 0.170	42	40	2	8	8	0	17	1
Grain crops	: 0.001	0	0		0	0		0	
Sweet potato	: 0.120	90	48	2	14	8	0	22	0
Taro	: 0.094	123	39	6	21	7	1	29	1
Yam	: 0.003	10	3		1	0		2	
Pana	: 0.018	20	6		3	1		4	
Other	0.004								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	<----- work hours ----->			<----- work days ----->			% contribution to family labour	
	men	women	paid	men	women	paid	men	women
Labour units available	1.88	1.88	1.00					
Total	293	106	10	46	17	1	74	26
Cleared land	5	3		1	0		62	38
Coconut	137	30		20	4		82	18
Cocoa	22	21	2	4	4	0	51	49
Grain crops	0	0		0	0		29	71
Sweet potato	48	26	2	8	4	0	65	35
Taro	65	21	6	11	4	1	76	24
Yam	5	1		1	0		79	21
Pana	11	3		2	1		76	24

Derived from household composition labour availability

* contribution to family labour is derived from the table above

Table: A2.2

LABOUR OPERATIONS ON CULTIVATION (per hectare)

					<----- labour input ----->						labour
					<--- per season --->			<-- per year -->			cost
					<---- hours/ha ---->			hours	days		
					men	women	paid	(hrs/ha)	(d/ha)	(\$/ha/yr)	
i) Labour input by main crop growing in the plot											
All plots summary	:	101	0.146	1.01	6.4	844	365	0	1221	192	0.21
Cleared land	a:	6	0.670	1.00	6.5	183			183	28	-
Coconut	b:	8	0.690	1.00	6.6	431	227		658	99	
Cocoa	c:	1	0.005	1.00	3.0		566		566	189	
Grain crops	e:	2	0.012	1.00	3.0	77	283		360	120	
Sweet potato	r:	33	0.064	1.03	6.4	656	425		1114	174	
Taro	s:	32	0.075	1.00	6.5	950	556	1	1507	231	0.67
Yam	t:	4	0.016	1.00	7.0	3082	167		3249	464	
Pana	u:	15	0.041	1.00	6.3	1076	117		1193	188	

<- average number of workers ->					<-- % contribution -->			
men	women	paid	total		men	women	paid	
ii) Labour composition								
All plots summary	:	1.6	0.8	0.1	2.4	70	30	0
Cleared land	a:	1.2			1.2	100		
Coconut	b:	2.8	1.9		4.6	66	34	
Cocoa	c:		1.0		1.0		100	
Grain crops	e:	5.0	0.5		5.5	21	79	
Sweet potato	r:	1.4	0.8		2.1	61	39	
Taro	s:	1.5	0.8	0.2	2.5	63	37	0
Yam	t:	1.8	0.3		2.0	95	5	
Pana	u:	1.9	0.7		2.6	90	10	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

LABOUR OPERATIONS ON CULTIVATION (per holding)

i) Total time worked

		mean holding area (ha)	<----- work hours ----->			<----- work days ----->				labour cost (SIS)
			men	women	paid	men	women	paid	total	
Total	:	1.386	616	422	0	94	82	0	175	0
Cleared land	:	0.017	3			0			0	
Coconut	:	0.959	413	218		62	33		95	
Cocoa	:	0.170		96			32		32	
Grain crops	:	0.001	0	0		0	0		0	
Sweet potato	:	0.120	81	53		13	8		21	
Taro	:	0.094	89	52	0	14	8	0	22	0
Yam	:	0.003	9	1		1	0		1	
Pana	:	0.018	19	2		3	0		3	
Other		0.004								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	<----- work hours ----->			<----- work days ----->			% contribution to family labour	
	men	women	paid	men	women	paid	men	women
Labour units available	1.38	1.38	1.00					
Total	327	224	0	50	43	0	59	41
Cleared land	2			0			100	
Coconut	220	116		33	17		66	34
Cocoa		51			17			100
Grain crops	0	0		0	0		21	79
Sweet potato	43	28		7	4		61	39
Taro	48	28	0	7	4	0	63	37
Yam	5	0		1	0		95	5
Pana	10	1		2	0		90	10

Derived from household composition labour availability

% contribution to family labour is derived from the table above

Table: A2.3

LABOUR OPERATIONS ON PLANTING (per hectare)

					<----- labour input ----->					labour
					<--- per season ---->		<-- per year -->			cost
					<----- hours/ha ----->		hours	days		
					men	women	paid (hrs/ha)	(d/ha)		(\$/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary	:	102	0.145	1.08	6.2	625	490	1202	193	
Coconut	b:	6	0.670	1.00	6.5	193		193	30	
Cocoa	c:	8	0.690	1.00	6.6	430	227	657	99	
Grain crops	e:	2	0.012	1.00	2.5	52	283	335	134	
Vegetable	h:	2	0.008	1.00	2.0		547	547	274	
Fruit crops	j:	1	0.039	1.00	6.0	614		614	102	
Sweet potato	r:	33	0.064	1.06	6.4	434	505	996	157	
Taro	s:	31	0.077	1.13	6.5	651	740	1570	243	
Yam	t:	4	0.016	1.25	6.5	2814	634	4310	663	
Pana	u:	15	0.041	1.07	6.3	846	292	1214	194	

<- average number of workers ->					<-- % contribution -->		
men	women	paid	total		men	women	paid
ii) Labour composition							
All plots summary	:	1.1	1.1	2.2	56	44	
Coconut	b:	1.2		1.2	100		
Cocoa	c:	2.6	1.9	4.5	65	35	
Grain crops	e:	0.5	0.5	1.0	16	84	
Vegetable	h:		1.0	1.0		100	
Fruit crops	j:	1.0		1.0	100		
Sweet potato	r:	0.9	1.1	2.0	46	54	
Taro	s:	1.0	1.2	2.2	47	53	
Yam	t:	1.3	1.0	2.3	82	18	
Pana	u:	0.9	1.3	2.1	74	26	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
 2. "Hours per year" is the sum of hours per season multiplied by times per year.

LABOUR OPERATIONS ON PLANTING (per holding)

i) Total time worked

	mean holding area (ha)	<----- work hours ----->			<----- work days ----->				labour cost (SIS)
		men	women	paid	men	women	paid	total	
Total	: 1.386	412	190		64	30		93	
Cleared land	: 0.017								
Coconut	: 0.959	185			28			28	
Cocoa	: 0.170	73	39		11	6		17	
Grain crops	: 0.001	0	0		0	0		0	
Vegetable	: 0.001		1			0		0	
Fruit crops	: 0.004	2			0			0	
Sweet potato	: 0.120	55	64		9	10		19	
Taro	: 0.094	69	79		11	12		23	
Yam	: 0.003	11	2		2	0		2	
Pana	: 0.018	16	6		3	1		3	
Other									

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	<----- work hours ----->			<----- work days ----->			% contribution to family labour	
	men	women	paid	men	women	paid	men	women
Labour units available	1.88	1.88	1.00					
Total	219	101		34	16		68	32
Cleared land								
Coconut	98			15			100	
Cocoa	39	21		6	3		65	35
Grain crops	0	0		0	0		16	84
Vegetable		0			0			100
Fruit crops	1			0			100	
Sweet potato	29	34		5	5		46	54
Taro	37	42		6	6		47	53
Yam	6	1		1	0		32	18
Pana	9	3		1	0		74	26

Derived from household composition labour availability

% contribution to family labour is derived from the table above

Table: A2.4

LABOUR OPERATIONS ON ESTABLISHMENT (per hectare)

					<----- labour input ----->					labour
					<--- per season ---->		<-- per year -->			cost
					<----- hours/ha ----->		hours	days		
number	of	mean	operation	average	men	women	paid	(hrs/ha)	(d/ha)	(\$/ha/yr)
obs	plot	area	times	hours						
(plots)	area	(ha)	per	worked						
			year	per day						
i) Labour input by main crop growing in the plot										
All plots summary	:	1	2.347	1.00	4.0	5		5	1	
Coconut	b:	1	2.347	1.00	4.0	5		5	1	

<- average number of workers ->					<-- % contribution -->		
men	women	paid	total		men	women	paid
ii) Labour composition							
All plots summary	:	1.0		1.0	100		
Coconut	b:	1.0		1.0	100		

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
 2. "Hours per year" is the sum of hours per season multiplied by times per year.

LABOUR OPERATIONS ON ESTABLISHMENT (per holding)

i) Total time worked

	mean holding area (ha)	<----- work hours ----->			<----- work days ----->				labour cost (SIS)
		men	women	paid	men	women	paid	total	
Total	: 1.386	5			1			1	
Cleared land	: 0.017								
Coconut	: 0.959	5			1			1	
Cocoa	: 0.170								
Grain crops	: 0.001								
Vegetable	: 0.001								
Fruit crops	: 0.004								
Sweet potato	: 0.120								
Taro	: 0.094								
Yam	: 0.003								
Pana	: 0.018								
Other									

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	<----- work hours ----->			<----- work days ----->			* contribution to family labour	
	men	women	paid	men	women	paid	men	women
Labour units available	1.88	1.88	1.00					
Total	3			1			100	
Cleared land								
Coconut	3			1			100	
Cocoa								
Grain crops								
Vegetable								
Fruit crops								
Sweet potato								
Taro								
Yam								
Pana								

Derived from household composition labour availability

* contribution to family labour is derived from the table above

Table: A2.5

LABOUR OPERATIONS ON MAINTENANCE (per hectare)

					<----- labour input ----->						labour
					<--- per season ---->			<-- per year -->		cost	
					<----- hours/ha ----->			hours	days		
					men	women	paid	(hrs/ha)	(d/ha)	(\$/ha/yr)	
i) Labour input by main crop growing in the plot											
All plots summary	:	12	1.794	1.42	6.6	130	38	5	245	37	4.78
Coconut	b:	11	1.865	1.45	6.4	134	34	5	252	40	5.21
Cocoa	c:	1	1.012	1.00	9.0	89	89		178	20	

<- average number of workers ->					<-- % contribution -->			
men women paid total					men	women	paid	
ii) Labour composition								
All plots summary	:	1.8	0.8	0.7	3.3	75	22	3
Coconut	b:	1.9	0.7	0.7	3.4	77	20	3
Cocoa	c:	1.0	1.0		2.0	50	50	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
 2. "Hours per year" is the sum of hours per season multiplied by times per year.

LABOUR OPERATIONS ON MAINTENANCE (per holding)

i) Total time worked

	mean holding area (ha)	<----- work hours ----->			<----- work days ----->				labour cost (SIS)
		men	women	paid	men	women	paid	total	
Total	: 1.386	202	63	7	31	9	1	41	5
Cleared land	: 0.017								
Coconut	: 0.959	187	47	7	29	7	1	38	5
Cocoa	: 0.170	15	15		2	2		3	
Grain crops	: 0.001								
Vegetable	: 0.001								
Fruit crops	: 0.004								
Sweet potato	: 0.120								
Taro	: 0.094								
Yam	: 0.003								
Pana	: 0.018								
Other									

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	<----- work hours ----->			<----- work days ----->			% contribution to family labour	
	men	women	paid	men	women	paid	men	women
Labour units available	1.88	1.88	1.00					
Total	107	33	7	17	5	1	76	24
Cleared land								
Coconut	99	25	7	16	4	1	80	20
Cocoa	8	8		1	1		50	50
Grain crops								
Vegetable								
Fruit crops								
Sweet potato								
Taro								
Yam								
Pana								

Derived from household composition labour availability

% contribution to family labour is derived from the table above

Table: A2.6

LABOUR OPERATIONS ON FIRST WEEDING (per hectare)

					<----- labour input ----->					labour
					<--- per season ---->		<-- per year -->			cost
					<----- hours/ha ----->		hours	days		
					men	women	paid (hrs/ha)	(d/ha)	(\$/ha/yr)	
number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day							
i) Labour input by main crop growing in the plot										
All plots summary :	74	0.117	1.03	5.8	125	371	509	87		
Coconut b:	4	0.354	1.00	7.3	118		118	16		
Cocoa c:	2	1.275	1.00	6.0	46	4	50	3		
Sweet potato r:	24	0.076	1.04	5.6	66	377	461	83		
Taro s:	25	0.088	1.04	5.8	57	478	556	96		
Yam t:	4	0.016	1.00	6.5	688	710	1398	215		
Pana u:	15	0.041	1.00	5.7	195	241	436	77		

<- average number of workers ->					<-- % contribution -->		
men	women	paid	total		men	women	paid
ii) Labour composition							
All plots summary :	0.4	1.1	1.5		25	75	
Coconut b:	1.8		1.8	100			
Cocoa c:	1.0	0.5	1.5	92	3		
Sweet potato r:	0.3	1.0	1.3	15	95		
Taro s:	0.3	1.4	1.7	11	99		
Yam t:	5.0	1.0	6.0	49	51		
Pana u:	0.5	0.9	1.4	45	55		

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
 2. "Hours per year" is the sum of hours per season multiplied by times per year.

LABOUR OPERATIONS ON FIRST WEEDING (per holding)

i) Total time worked

	mean holding area (ha)	<----- work hours ----->			<----- work days ----->				labour cost (SIS)
		men	women	paid	men	women	paid	total	
Total	: 1.386	140	101		20	18		38	
Cleared land	: 0.017								
Coconut	: 0.959	113			16			16	
Cocoa	: 0.170	8	1		1	0		1	
Grain crops	: 0.001								
Vegetable	: 0.001								
Fruit crops	: 0.004								
Sweet potato	: 0.120	3	47		1	8		10	
Taro	: 0.094	6	47		1	8		9	
Yam	: 0.003	2	2		0	0		1	
Pana	: 0.018	4	4		1	1		1	
Other									

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	<----- work hours ----->			<----- work days ----->			% contribution to family labour	
	men	women	paid	men	women	paid	men	women
Labour units available	1.38	1.38	1.00					
Total	75	54		11	9		58	42
Cleared land								
Coconut	60			8			100	
Cocoa	4	0		1	0		92	8
Grain crops								
Vegetable								
Fruit crops								
Sweet potato	4	25		1	4		15	85
Taro	3	25		1	4		11	89
Yam	1	1		0	0		49	51
Pana	2	2		0	0		45	55

Derived from household composition labour availability

* contribution to family labour is derived from the table above

Table: A2.7

LABOUR OPERATIONS ON SECOND WEEDING (per hectare)

		number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	<----- labour input ----->				labour
						<--- per season ---->		<-- per year -->		cost
						<----- hours/ha ----->		hours	days	
						men	women	paid (hrs/ha)	(d/ha)	(\$/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary	:	10	0.146	1.00	6.1	123	122	245	40	
Coconut	b:	3	0.296	1.00	6.7	50		50	7	
Sweet potato	r:	3	0.119	1.00	6.3	201	254	455	72	
Taro	s:	4	0.053	1.00	5.5	119	114	233	42	

<- average number of workers ->					<-- % contribution -->		
men women paid total					men women paid		
ii) Labour composition							
All plots summary :		1.1	1.0	2.1	50	50	
Coconut b:		1.3	1.0	2.3	100		
Sweet potato r:		0.7	1.0	1.7	44	56	
Taro s:		1.3	1.0	2.3	51	49	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
 2. "Hours per year" is the sum of hours per season multiplied by times per year.

LABOUR OPERATIONS ON SECOND WEEDING (per holding)

i) Total time worked

	mean holding area (ha)	<----- work hours ----->			<----- work days ----->				labour cost (SIS)
		men	women	paid	men	women	paid	total	
Total	: 1.386	83	41		13	7		20	
Cleared land	: 0.017								
Coconut	: 0.959	48			7			7	
Cocoa	: 0.170								
Grain crops	: 0.001								
Vegetable	: 0.001								
Fruit crops	: 0.004								
Sweet potato	: 0.120	24	30		4	5		9	
Taro	: 0.094	11	11		2	2		4	
Yam	: 0.003								
Pana	: 0.018								
Other									

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	<----- work hours ----->			<----- work days ----->			% contribution to family labour	
	men	women	paid	men	women	paid	men	women
Labour units available	1.88	1.88	1.00					
Total	44	22		7	4		67	33
Cleared land								
Coconut	26			4			100	
Cocoa								
Grain crops								
Vegetable								
Fruit crops								
Sweet potato	13	16		2	3		44	56
Taro	6	6		1	1		51	49
Yam								
Pana								

Derived from household composition labour availability

% contribution to family labour is derived from the table above

Table: A2.8

LABOUR OPERATIONS ON THIRD WEEDING (per hectare)

					<----- labour input ----->					labour
					<--- per season ---->		<-- per year -->		cost	
					<----- hours/ha ----->		hours	days		
					men	women	paid (hrs/ha)	(d/ha)	(\$/ha/yr)	
i) Labour input by main crop growing in the plot										
All plots summary	:	2	0.372	1.00	6.5	35		35	5	
Coconut	b:	2	0.372	1.00	6.5	35		35	5	

<- average number of workers ->					<-- % contribution -->		
men women paid total					men	women	paid
ii) Labour composition							
All plots summary	:	1.0		1.0	100		
Coconut	b:	1.0		1.0	100		

LABOUR OPERATIONS ON THIRD WEEDING (per holding)

i) Total time worked

	mean holding area (ha)	<----- work hours ----->			<----- work days ----->				labour cost (SIS)
		men	women	paid	men	women	paid	total	
Total	: 1.386	34			5			5	
Cleared land	: 0.017								
Coconut	: 0.959	34			5			5	
Cocoa	: 0.170								
Grain crops	: 0.001								
Vegetable	: 0.001								
Fruit crops	: 0.004								
Sweet potato	: 0.120								
Taro	: 0.094								
Yam	: 0.003								
Pana	: 0.018								
Other									

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	<----- work hours ----->			<----- work days ----->			% contribution to family labour	
	men	women	paid	men	women	paid	men	women
Labour units available	1.88	1.88	1.00					
Total	18			3			100	
Cleared land								
Coconut	18			3			100	
Cocoa								
Grain crops								
Vegetable								
Fruit crops								
Sweet potato								
Taro								
Yam								
Pana								

Derived from household composition labour availability

* contribution to family labour is derived from the table above

Table: A2.9

LABOUR OPERATIONS ON HARVESTING (per hectare)

					<----- labour input ----->				labour
					<--- per season ---->		<-- per year -->		cost
					<----- hours/ha ----->		hours	days	
					men	women	paid (hrs/ha)	(d/ha)	(\$/ha/yr)
i) Labour input by main crop growing in the plot									
All plots summary		:	52	0.080	1.98	1.3	53	136	374 282
Cocoa		c:	1	0.097	3.00	6.0	186	186	1116 186
Sweet potato		r:	35	0.088	1.89	1.3	61	160	417 310
Taro		s:	10	0.082	2.30	1.0		69	159 159
Yam		t:	2	0.014	2.50	1.0	92	193	713 713
Pana		u:	4	0.036	1.50	1.0	57	49	159 159

<- average number of workers ->					<-- % contribution -->		
men	women	paid	total		men	women	paid
ii) Labour composition							
All plots summary	:	0.1	1.0	1.1	28	72	
Cocoa	c:	1.0	1.0	2.0	50	50	
Sweet potato	r:	0.1	1.0	1.1	28	72	
Taro	s:		1.0	1.0		100	
Yam	t:	1.0	1.0	2.0	32	68	
Pana	u:	0.5	0.5	1.0	54	46	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
 2. "Hours per year" is the sum of hours per season multiplied by times per year.

LABOUR OPERATIONS ON HARVESTING (per holding)

i) Total time worked

	mean holding area (ha)	<----- work hours ----->			<----- work days ----->				labour cost (SIS)
		men	women	paid	men	women	paid	total	
Total	: 1.386	111	149		28	60		89	
Cleared land	: 0.017								
Coconut	: 0.959								
Cocoa	: 0.170	95	95		16	16		32	
Grain crops	: 0.001								
Vegetable	: 0.001								
Fruit crops	: 0.004								
Sweet potato	: 0.120	14	36		10	27		37	
Taro	: 0.094		15			15		15	
Yam	: 0.003	1	1		1	1		2	
Pana	: 0.018	2	1		2	1		3	
Other									

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	<----- work hours ----->			<----- work days ----->			% contribution to family labour	
	men	women	paid	men	women	paid	men	women
Labour units available	1.88	1.88	1.00					
Total	59	79		15	32		43	57
Cleared land								
Coconut								
Cocoa	50	50		8	8		50	50
Grain crops								
Vegetable								
Fruit crops								
Sweet potato	7	19		5	14		28	72
Taro		8			8			100
Yam	0	1		0	1		32	68
Pana	1	1		1	1		54	46

Derived from household composition labour availability

* contribution to family labour is derived from the table above

Annex: 3
CROP DAMAGE

A3.1 The following analysis of crop damage is based on observations of crop mixtures at the plot level. Tables show the dominant crop growing in the mixture, but damage encountered may refer to other crops in the plot. In the present analysis it is possible only to present results at the plot level, and not at the crop level.

LAND CLEARANCE

Annual Labour per Holding

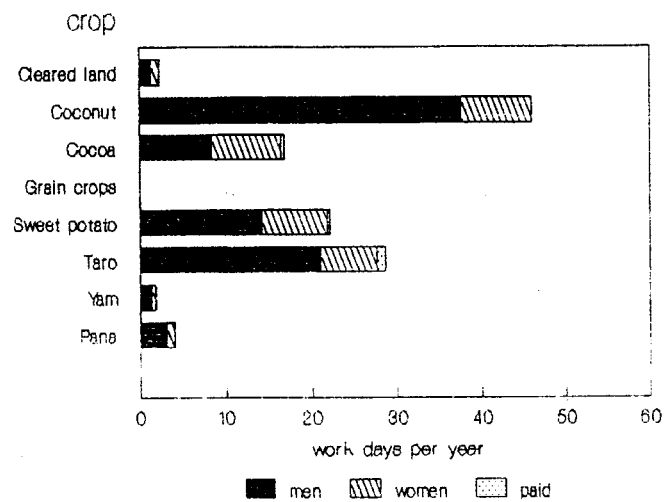


Diagram: A2.1

CULTIVATION

Annual Labour per Holding

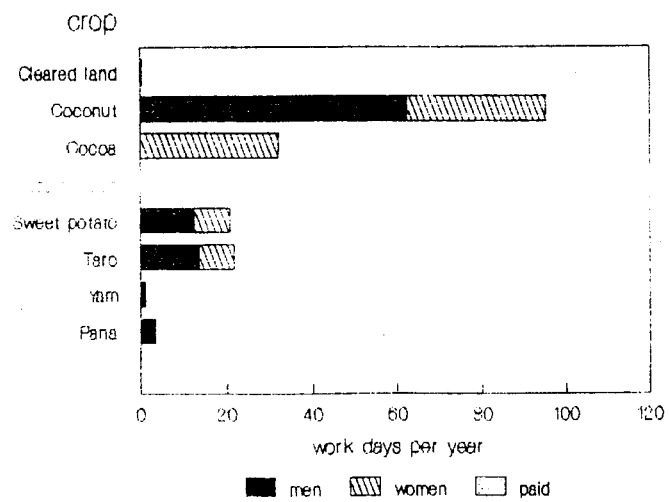


Diagram: A2.2

PLANTING

Annual Labour per Holding

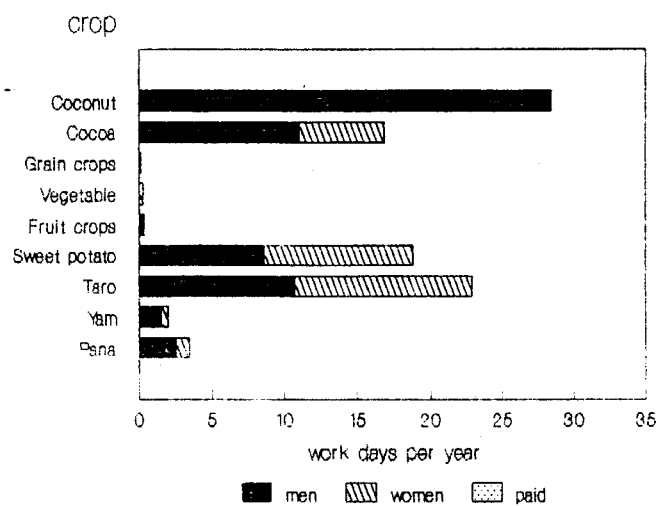


Diagram: A2.3

CROPS ESTABLISHMENT

Annual Labour per Holding

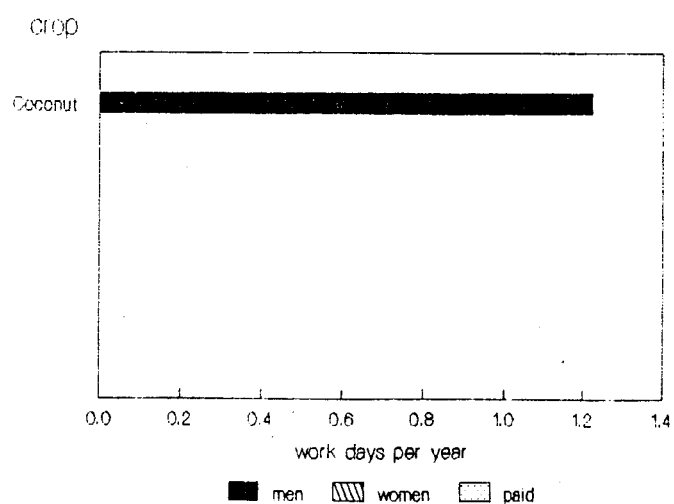


Diagram: A2.4

CROPS MAINTENANCE

Annual Labour per Holding

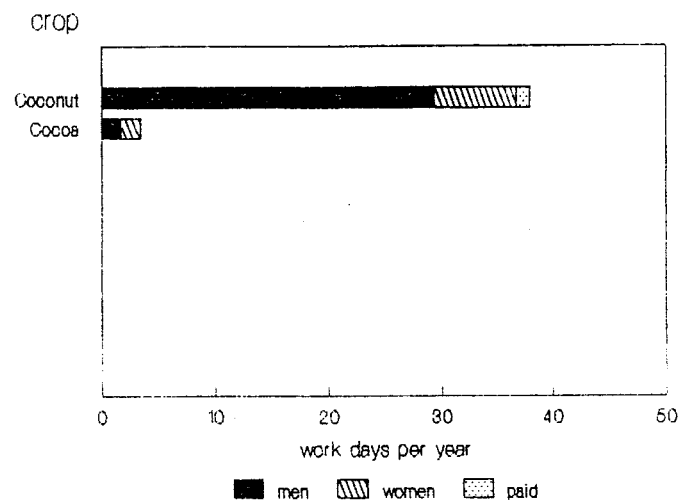


Diagram: A2.5

FIRST WEEDING

Annual Labour per Holding

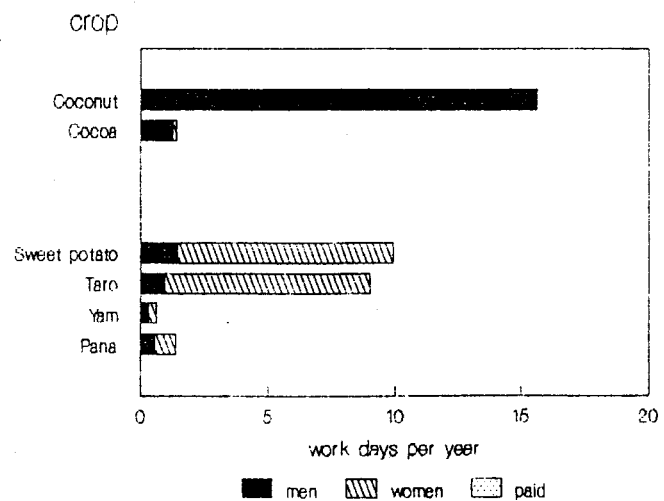


Diagram: A2.6

SECOND WEEDING

Annual Labour per Holding

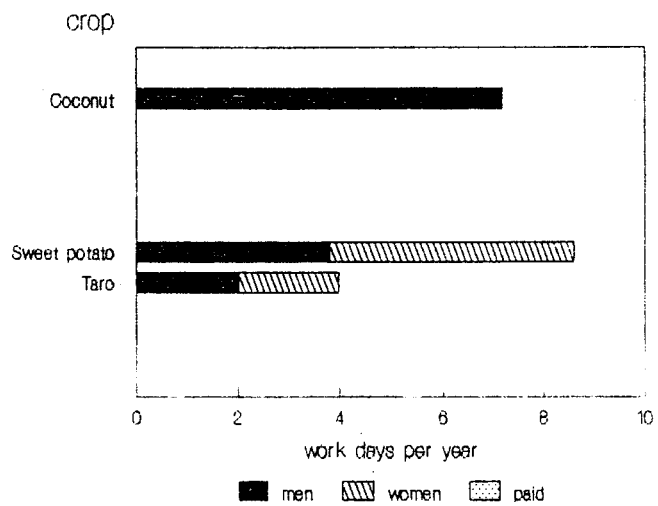


Diagram: A2.7

THIRD WEEDING

Annual Labour per Holding

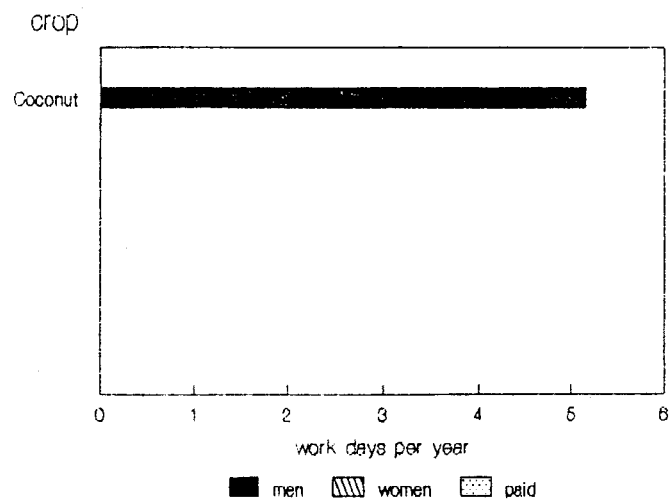


Diagram: A2.8

HARVESTING

Annual Labour per Holding

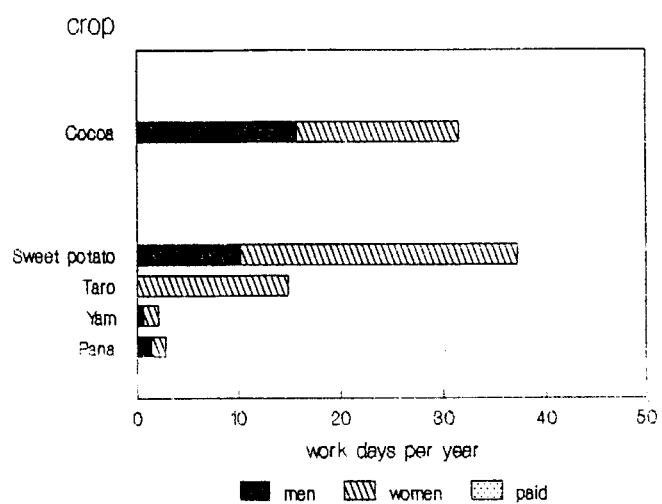


Diagram: A2.9

Table: A3.1a

CROP DAMAGE DUE TO INSECTS - AFFECTING LEAVES

i) Frequency of plots damaged

extent of damage:		little	consid- erable	severe	crop devastated	I	total # plots	% affected	% unaffected
all plots		18	8			I	207	13	87
cleared land	a	////	////	////	////	I	13		100
coconut	b					I	25		100
cocoa	c	1				I	11	9	91
grain crops	e					I	2		100
vegetable	h					I	3		100
fruit crops	j					I	2		100
sweet potato	r	9	3			I	73	16	84
taro	s	7	5			I	54	22	78
yam	t					I	7		100
pana	u	1				I	17	6	94

ii) % crop area affected

extent of damage:		little	consid- erable	severe	crop devastated	I	% affected	% unaffected
% total cropped area		4				I	4	96
cleared land	a					I		100
coconut	b					I		100
cocoa	c					I		100
grain crops	e					I		100
vegetable	h					I		100
fruit crops	j					I		100
sweet potato	r	20				I	20	80
taro	s	25				I	25	75
yam	t					I		100
pana	u					I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.1b
CROP DAMAGE DUE TO INSECTS - AFFECTING FRUITS

i) Frequency of plots damaged

extent of damage:		little	consid- erable	severe	crop devastated	I	total # plots	% affected	% unaffected
all plots		19	1			I	207	10	90
cleared land	a	////////////////	////////////////	////////////////	////////////////	I	13		100
coconut	b	2	1			I	25	12	88
cocoa	c	2				I	11	18	82
grain crops	e					I	2		100
vegetable	h					I	3		100
fruit crops	j					I	2		100
sweet potato	r	9				I	73	12	88
taro	s	6				I	54	11	89
yam	t					I	7		100
pana	u					I	17		100

ii) % crop area affected

extent of damage:		little	consid- erable	severe	crop devastated	I	% affected	% unaffected
* total cropped area		7	4			I	11	89
cleared land	a					I		100
coconut	b	3	5			I	8	92
cocoa	c	14				I	14	86
grain crops	e					I		100
vegetable	h					I		100
fruit crops	j					I		100
sweet potato	r	20				I	20	80
taro	s	25				I	25	75
yam	t					I		100
pana	u					I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.1c
CROP DAMAGE DUE TO INSECTS - AFFECTING ROOTS

i) Frequency of plots damaged

extent of damage:		little	consid- erable	severe	crop devastated	I	total # plots	% affected	% unaffected
all plots						I	207		100
cleared land	a	////////////////	////////////////	////////////////	////////////////	I	13		100
coconut	b					I	25		100
cocoa	c					I	11		100
grain crops	e					I	2		100
vegetable	h					I	3		100
fruit crops	j					I	2		100
sweet potato	r					I	73		100
taro	s					I	54		100
yam	t					I	7		100
pana	u					I	17		100

ii) % crop area affected

extent of damage:		little	consid- erable	severe	crop devastated	I	% affected	% unaffected
% total cropped area						I		100
cleared land	a					I		100
coconut	b					I		100
cocoa	c					I		100
grain crops	e					I		100
vegetable	h					I		100
fruit crops	j					I		100
sweet potato	r					I		100
taro	s					I		100
yam	t					I		100
pana	u					I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.2a
CROP DAMAGE DUE TO DISEASE - AFFECTING LEAVES

i) Frequency of plots damaged

extent of damage:		little	consid- erable	severe	crop I devastatedI	total # plots	% affected	% unaffected
all plots		18	17	2	I	207	18	82
cleared land	a	//////////	//////////	//////////	I	13		100
coconut	b				I	25		100
cocoa	c				I	11		100
grain crops	e				I	2		100
vegetable	h				I	3		100
fruit crops	j				I	2		100
sweet potato	r	9	9	1	I	73	26	74
taro	s	7	8	1	I	54	30	70
yam	t				I	7		100
pana	u	2			I	17	12	88

ii) % crop area affected

extent of damage:		little	consid- erable	severe	crop I devastatedI	% affected	% unaffected
% total cropped area		2	2		I	4	96
cleared land	a				I		100
coconut	b				I		100
cocoa	c				I		100
grain crops	e				I		100
vegetable	h				I		100
fruit crops	j				I		100
sweet potato	r		20		I	20	80
taro	s	25			I	25	75
yam	t				I		100
pana	u				I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.2a
CROP DAMAGE DUE TO DISEASE - AFFECTING FRUITS

i) Frequency of plots damaged

extent of damage:		little	consid- erable	severe	crop devastated	I	total # plots	% affected	% unaffected
all plots		11	1			I	207	6	94
cleared land	a	//////////	//////////	//////////	//////////	I	13		100
coconut	b					I	25		100
cocoa	c					I	11		100
grain crops	e					I	2		100
vegetable	h					I	3		100
fruit crops	j					I	2		100
sweet potato	r	8				I	73	11	89
taro	s	3	1			I	54	7	93
yam	t					I	7		100
pana	u					I	17		100

ii) % crop area affected

extent of damage:		little	consid- erable	severe	crop devastated	I	% affected	% unaffected
% total cropped area		2				I	2	98
cleared land	a					I		100
coconut	b					I		100
cocoa	c					I		100
grain crops	e					I		100
vegetable	h					I		100
fruit crops	j					I		100
sweet potato	r	20				I	20	80
taro	s					I		100
yam	t					I		100
pana	u					I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.2c

CROP DAMAGE DUE TO DISEASE - AFFECTING ROOTS

i) Frequency of plots damaged

extent of damage:		little	consid- erable	severe	crop devastated	I	total # plots	% affected	% unaffected
all plots						I	207		100
cleared land	a	////////////////	////////////////	////////////////	////////////////	I	13		100
coconut	b					I	25		100
cocoa	c					I	11		100
grain crops	e					I	2		100
vegetable	h					I	3		100
fruit crops	j					I	2		100
sweet potato	r					I	73		100
taro	s					I	54		100
yam	t					I	7		100
pana	u					I	17		100

ii) % crop area affected

extent of damage:		little	consid- erable	severe	crop devastated	I	% affected	% unaffected
% total cropped area						I		
cleared land	a					I		100
coconut	b					I		100
cocoa	c					I		100
grain crops	e					I		100
vegetable	h					I		100
fruit crops	j					I		100
sweet potato	r					I		100
taro	s					I		100
yam	t					I		100
pana	u					I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.3
CROP DAMAGE DUE TO HUMANS

i) Frequency of plots damaged

extent of damage:		little	consid- erable	severe	crop devastated	I	total # plots	% affected	% unaffected
all plots						I	207		100
cleared land	a	////////////////	////////////////	////////////////	////////////////	I	13		100
coconut	b					I	25		100
cocoa	c					I	11		100
grain crops	e					I	2		100
vegetable	h					I	3		100
fruit crops	j					I	2		100
sweet potato	r					I	73		100
taro	s					I	54		100
yam	t					I	7		100
pana	u					I	17		100

ii) % crop area affected

extent of damage:		little	consid- erable	severe	crop devastated	I	% affected	% unaffected
% total cropped area						I		100
cleared land	a					I		100
coconut	b					I		100
cocoa	c					I		100
grain crops	e					I		100
vegetable	h					I		100
fruit crops	j					I		100
sweet potato	r					I		100
taro	s					I		100
yam	t					I		100
pana	u					I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.4
CROP DAMAGE DUE TO FIRE

i) Frequency of plots damaged

extent of damage:		little	consid- erable	severe	crop devastated	I	total # plots	% affected	% unaffected
all plots						I	207		100
cleared land	a	////////	////////	////////	////////	I	13		100
coconut	b					I	25		100
cocoa	c					I	11		100
grain crops	e					I	2		100
vegetable	h					I	3		100
fruit crops	j					I	2		100
sweet potato	r					I	73		100
taro	s					I	54		100
yam	t					I	7		100
pana	u					I	17		100

ii) % crop area affected

extent of damage:		little	consid- erable	severe	crop devastated	I	% affected	% unaffected
% total cropped area						I		100
cleared land	a					I		100
coconut	b					I		100
cocoa	c					I		100
grain crops	e					I		100
vegetable	h					I		100
fruit crops	j					I		100
sweet potato	r					I		100
taro	s					I		100
yam	t					I		100
pana	u					I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.5
CROP DAMAGE DUE TO FLOOD

i) Frequency of plots damaged

extent of damage:		little	consid- erable	severe	crop I devastatedI	total # plots	% affected	% unaffected
all plots					I	207		100
cleared land	a	////////	////////	////////	I	13		100
coconut	b				I	25		100
cocoa	c				I	11		100
grain crops	e				I	2		100
vegetable	h				I	3		100
fruit crops	j				I	2		100
sweet potato	r				I	73		100
taro	s				I	54		100
yam	t				I	7		100
pana	u				I	17		100

ii) % crop area affected

extent of damage:		little	consid- erable	severe	crop I devastatedI	% affected	% unaffected
% total cropped area					I		100
cleared land	a				I		100
coconut	b				I		100
cocoa	c				I		100
grain crops	e				I		100
vegetable	h				I		100
fruit crops	j				I		100
sweet potato	r				I		100
taro	s				I		100
yam	t				I		100
pana	u				I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.6
CROP DAMAGE DUE TO WIND

i) Frequency of plots damaged

extent of damage:	little	consid- erable	severe	crop I devastatedI	total # plots	% affected	% unaffected
all plots			1	I	207	0	100
cleared land	a	////////////////	////////////////	I	13		100
coconut	b		1	I	25	4	96
cocoa	c			I	11		100
grain crops	e			I	2		100
vegetable	h			I	3		100
fruit crops	j			I	2		100
sweet potato	r			I	73		100
taro	s			I	54		100
yam	t			I	7		100
pana	u			I	17		100

ii) % crop area affected

extent of damage:	little	consid- erable	severe	crop I devastatedI	% affected	% unaffected
% total cropped area			4	I	4	96
cleared land	a			I		100
coconut	b		5	I	5	95
cocoa	c			I		100
grain crops	e			I		100
vegetable	h			I		100
fruit crops	j			I		100
sweet potato	r			I		100
taro	s			I		100
yam	t			I		100
pana	u			I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.7
CROP DAMAGE DUE TO RATS

i) Frequency of plots damaged

extent of damage:		little	consid- erable	severe	crop devastated	I	total # plots	% affected	% unaffected
all plots		58	3	1	I		207	30	70
cleared land	a	//////////	//////////	//////////	//////////	I	13		100
coconut	b	8				I	25	32	68
cocoa	c	1				I	11	9	91
grain crops	e					I	2		100
vegetable	h					I	3		100
fruit crops	j					I	2		100
sweet potato	r	46	2	1		I	73	67	33
taro	s	2				I	54	4	96
yam	t					I	7		100
pana	u	1	1			I	17	12	88

ii) % crop area affected

extent of damage:		little	consid- erable	severe	crop devastated	I	% affected	% unaffected
% total cropped area		42				I	42	58
cleared land	a					I		100
coconut	b	51				I	51	49
cocoa	c	14				I	14	86
grain crops	e					I		100
vegetable	h					I		100
fruit crops	j					I		100
sweet potato	r	60				I	60	40
taro	s					I		100
yam	t					I		100
pana	u					I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.8
CROP DAMAGE DUE TO BIRDS

i) Frequency of plots damaged

extent of damage:		little	consid- erable	severe	crop I devastatedI	total # plots	% affected	% unaffected
all plots		1	1		I	207	1	99
cleared land	a	////////////////	////////////////	////////////////	I	13		100
coconut	b	1			I	25	4	96
cocoa	c				I	11		100
grain crops	e				I	2		100
vegetable	h				I	3		100
fruit crops	j				I	2		100
sweet potato	r		1		I	73	1	99
taro	s				I	54		100
yam	t				I	7		100
pana	u				I	17		100

ii) % crop area affected

extent of damage:		little	consid- erable	severe	crop I devastatedI	% affected	% unaffected
% total cropped area		4			I	4	96
cleared land	a				I		100
coconut	b	5			I	5	95
cocoa	c				I		100
grain crops	e				I		100
vegetable	h				I		100
fruit crops	j				I		100
sweet potato	r				I		100
taro	s				I		100
yam	t				I		100
pana	u				I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.9
CROP DAMAGE DUE TO BATS

i) Frequency of plots damaged

extent of damage:		little	consid- erable	severe	crop devastated	I	total # plots	% affected	% unaffected
all plots		1			I		207	0	100
cleared land	a	////////////////	////////////////	////////////////	////////////////	I	13		100
coconut	b	1				I	25	4	96
cocoa	c					I	11		100
grain crops	e					I	2		100
vegetable	h					I	3		100
fruit crops	j					I	2		100
sweet potato	r					I	73		100
taro	s					I	54		100
yam	t					I	7		100
pana	u					I	17		100

ii) % crop area affected

extent of damage:		little	consid- erable	severe	crop devastated	I	% affected	% unaffected
% total cropped area		4				I	4	96
cleared land	a					I		100
coconut	b	5				I	5	95
cocoa	c					I		100
grain crops	e					I		100
vegetable	h					I		100
fruit crops	j					I		100
sweet potato	r					I		100
taro	s					I		100
yam	t					I		100
pana	u					I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.10
CROP DAMAGE DUE TO LIVESTOCK

i) Frequency of plots damaged

extent of damage:		little	consid- erable	severe	crop devastated	I	total # plots	% affected	% unaffected
all plots		9	12	9	I		207	14	86
cleared land	a	////////	////////	////////	////////	I	13		100
coconut	b					I	25		100
cocoa	c					I	11		100
grain crops	e					I	2		100
vegetable	h					I	3		100
fruit crops	j					I	2		100
sweet potato	r	5	6	4		I	73	21	79
taro	s	3	6	3		I	54	22	78
yam	t					I	7		100
pana	u	1		2		I	17	18	82

ii) % crop area affected

extent of damage:		little	consid- erable	severe	crop devastated	I	% affected	% unaffected
% total cropped area			4			I	4	96
cleared land	a					I		100
coconut	b					I		100
cocoa	c					I		100
grain crops	e					I		100
vegetable	h					I		100
fruit crops	j					I		100
sweet potato	r		20			I	20	80
taro	s		25			I	25	75
yam	t					I		100
pana	u					I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.11
CROP DAMAGE DUE TO OTHER FACTORS

i) Frequency of plots damaged

extent of damage:		little	consid- erable	severe	crop I devastatedI	total # plots	% affected	% unaffected
all plots		12			I	207	6	94
cleared land	a	////////////////////	////////////////////	////////////////////	I	13		100
coconut	b				I	25		100
cocoa	c				I	11		100
grain crops	e				I	2		100
vegetable	h				I	3		100
fruit crops	j				I	2		100
sweet potato	r	12			I	73	16	84
taro	s				I	54		100
yam	t				I	7		100
pana	u				I	17		100

ii) % crop area affected

extent of damage:		little	consid- erable	severe	crop I devastatedI	% affected	% unaffected
* total cropped area		2			I	2	98
cleared land	a				I		100
coconut	b				I		100
cocoa	c				I		100
grain crops	e				I		100
vegetable	h				I		100
fruit crops	j				I		100
sweet potato	r	20			I	20	80
taro	s				I		100
yam	t				I		100
pana	u				I		100

Note: The table of % area is only approximate due to rounding small numbers

Annex: 4
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